INTERFACE AGE™

MICROCOMPUTING FOR SMALL BUSINESS AND HOME VOLUME 2, ISSUE 12, NOVEMBER 1977

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CIRCLE INQUIRY NO. 44

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CIRCLE INQUIRY NO. 12

VOL. 2, ISSUE 12 NOVEMBER 1977

COVER STORY

This month's cover and cover story could be also entitled "Ellis Through the Looking Glass." The design and photography are the work of the author and his brother. The composition graphically depicts the point of the "Point Humans" theory. It also offers a clue to the puzzle in Figure 4 on Page 45. In the December issue Ellis Cooper will give the readers the solution to the puzzle. Watch for it in the "Letters" section.

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INTERFACE AGE™

MICROCOMPUTING FOR HOME AND THE SMALL BUSINESSMAN

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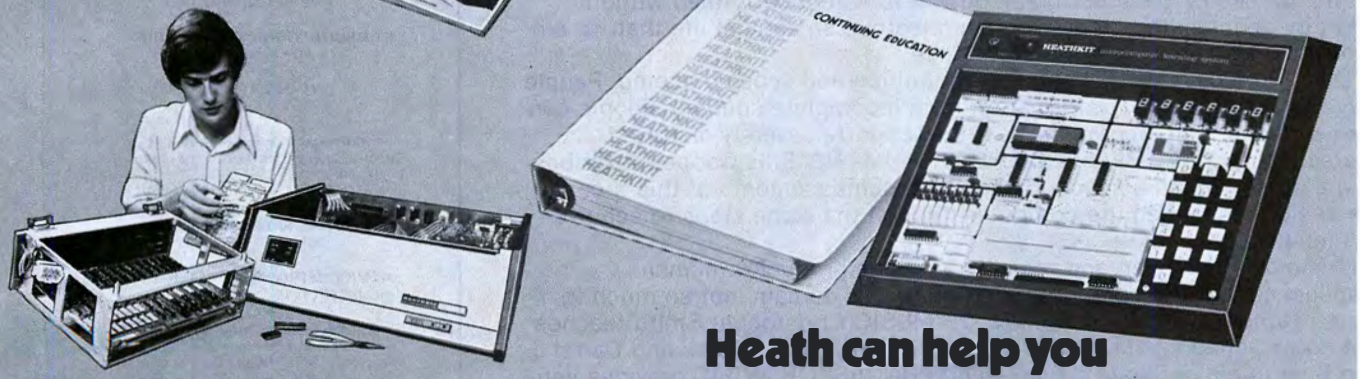
Powerful Computers from Heath!

The Software...

When it comes right down to it, your computer is really only as good as its software. That's why Heath has gone to such great lengths to provide our computers with quality software packages.

H8 comes complete with systems software for BASIC; HASL-8, a 2-pass absolute assembler; TED-8, a line oriented text editor; and BUG-8, a powerful terminal console debug program. Moving up to the H11 you'll find that this computer comes complete with Digital Equipment Corporation's (DEC) powerful PDP-11 software, including BASIC and DEC's FOCAL, PAL-11S assembler, editor, linker and a variety of utility programs.



The Support...

Still learning about computers? No problem. Heath's excellent assembly manuals and checkout procedures will help you get your system up and running fast. And when you're ready to learn BASIC, our excellent EC-1100 BASIC Programming Course will teach you the fundamentals and expand your knowledge to the point where you'll be able to create your own unique programs and problem solutions. Finally, if you're interested in the electronics of microprocessors, the EE-3401/ ET-3400 Microprocessor Course and Trainer will give you a thorough working knowledge of application, operation, interfacing and programming along with valuable "hands-on" experience. With this kind of support from assembly to completed system it's easy to see why with Heath, YOU'RE the computer expert!

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INTERFACIAL

For decades the computer has borne the cognomen "electronic brain" and this name in turn has influenced our thinking about the device and its functions. A mystique has grown around that machine, sometimes expressed in fear, othertimes in overconfidence of its capabilities. It is only brainlike because it is a product of human intelligence seeking to understand itself.

However, to build an inorganic analog of the organic computer requires understanding of each and every level of function exercised by the CPU within our skulls. We must break down every step performed without effort by people, steps that have been learned so early in life that we are unaware of the logic of the performance.

That is the case with character recognition and space mapping. People and animals can derive information from incomplete sources. People can read sense into an incomplete text or recognize severely distorted characters. In THE THEORY OF POINT HUMANS, Ellis Cooper describes how a person maps a space. By applying some elements of this theory, the designer can lead the computer through the same steps to achieve like results.

Music also has been and remains a unique product of human intelligence, but the computer is entering this domain, not so much to create, rather to assist. In A BYTE OF MUSIC Christopher Smith teaches you how to enable your microprocessor to play the Classics and Darrel J. Van Buer in his software article MOLYPROCESSOR MUSIC provides you with a system for playing, editing and programming.

Fingerprinting, another subject filled with menacing mystique, draws upon computer technology to accomplish its function. in our inhouse-authored article, much of the glowering mystery is revealed. The computer here becomes criminologist and assists law enforcement agencies in protecting public weal while drastically reducing expense in time and money.

Take a look at the staff box on page 6. Many changes in personnel have taken place: new names are added, old familiars are gone. Roger Garrett and William Turner will continue contributing their excellent articles while serving as Regional Editors. This is the last month in which Bob Stevens edits the Software Section. Replacing him is Dr. Abraham Perez whose *curriculum vitae* appears in the Software Editorial. Read it and be impressed. We are awestruck by the quantity of education and skills acquired in this one man's lifetime. We are publishing this not to boast, rather to advise our readers that they can henceforth expect the highest standards of professionalism that the engineering field can offer.

Bob Stevens did a competent job, but in technical journalism engineering degrees and skills alone are not enough. The technical journalist, like all other members of the Fourth Estate, bears a responsibility beyond the selection and preparation of articles for publication. He must attempt at all times to be as objective as is humanly possible and must sublimate his natural urges for personal acquisition. That is not always easy since journalists are never overpaid, often tempted by their story sources and have vulnerable egos. Evenso, the code of the Estate imposes this strict discipline upon its members and tolerates no exceptions. Harry Truman once quipped "If you don't like the heat . . ." Everyone knows the rest of the statement.

—L.F.-S.

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CIRCLE INQUIRY NO. 3

LETTERS TO THE EDITOR

Dear Editor:

I find INTERFACE AGE one of the best publications in the field and you are to be congratulated on a job well done. As a long term electronics engineer (and now in another field) I grew up with computers and can remember the days that I didn't mind spending an hour balancing the DC amps on an early analog computer (does anyone else remember them?) to get a marginal result. In any case since I have been out of the direct EE field for the past several years I miss the use of computer facilities. As a result I have for the past year-and-a-half been watching the microcomputer market very closely. After 20 years of experience in project engineering, program management and consulting in the electronics industry I felt sure the helter skelter of this new area would have to settle down. It has started but still has a long way to go. The personal computer business has one heck of a potential which has only had the surface scratched and I feel that it is time that the industry should become a little more practical and give a little more consideration to the long term aspects. To date the industry seems to have been mostly concerned with technology for the sake of technology and one cannot question this, based on the advances during the past years.

I would like to run a few things up the old flag pole that I have not seen addressed to any extent. I would like to present a few analogous situations:

1. When the auto came into vogue there were quite quickly more manufacturers than you could shake a stick at but in only a few technology years there were but a few remaining.

2. Ham radio started much the same as the micro industry but then CB came along and American producers lost their bubble to Japan.

3. The story on calculators, TV, HiFi, Stereo, and radio is much the same.

I can well expect to add the microcomputer to this list (at least in the personal field). To date the micro-industry caters to a limited market much like the ham radio market. There is in fact a large market out there waiting (just like the CB market). This untapped market sits there and waits while micro producers fight about bus design, the best CPU, and on and on.

Bus design, type of CPU and so on are of no concern to this large group of potential users who may not need but who would buy computing facilities if they could put them to direct and useful work or play. One step in the right direction would be to adopt an industry-wide conversational programming language (such as a standardized BASIC) that could easily be used by most and in which all programs could be written. A good example of this would be INTERFACE's Floppy ROM. The concept has to be one of the best I have seen but it is in fact only useful to the guy who has the same equipment configuration as the originator. That fact alone says that this great idea is only useful to a small percentage of your readers. Were there a standard BASIC and a Floppy ROM in BASIC that everyone used it would be a really useful tool to many more folks. In my case I could find a use (with some modification) of the September Floppy ROM but I would never buy the Model T system that it could run on. On top of that my kids didn't even enjoy listening to it.

In short, what I am trying to say is that the industry should get on the stick and establish a standard program language that is easily useable by as many as possible (I would recommend a standardized BASIC). The industry should give thanks to the computer hams that got it started but should recognize the fact that these folks cannot keep them in business. The buyer of micro products should realize that many of the current sellers of gear (especially those just selling boards) are not likely to be here a year or two from today. Many of these operations have little to offer other than the fact that they have taken semiconductor manufacturers' applications literature and set up a garage type operation.

In closing I would like to complement those computer hams that bought those first off-the-line systems and helped get this new industry on its feet. I would only hope that these folks have enjoyed, learned from and found good use for their systems since as we all know prices are going down every month. I would only hope that those in the industry will take advantage of their capabilities and hit the real market before they give it away to non-US companies.

G. W. Stomberg
Las Cruces, NM

Right now the reply is brief because we don't want to give away a coming surprise. Thanks, and hang in there!
—Editor

Dear Editor:

I am a new subscriber and I like your magazine very much. However, many of your articles are almost unintelligible due to the large numbers of abbreviations used within. I know a good bit about computers, but still some of the articles sound like this: "Hexco has just brought out a new 7734z that makes all previous 7777 z's obsolete due to its new ASDF generator, which makes better use of the ROM, PROM, FRIP, DRIP and DRAT functions on the MOS." To someone who doesn;t know all the abbreviations, such articles are difficult to read. I feel that they would be easier to understand if a listing of abbreviations used in the magazine were included somewhere in the magazine, along with the meanings of these abbreviations. Such a listing would probably take up only a few square inches of space.

Also, I think that a computer basics column would be very helpful to readers just getting into computers. For example, one month's column could deal with computer logic and another month's column might discuss printers, or floppies, or busses, or almost anything.

Jim Angel
Baden, PA

I suggest you invest in an electronics and microcomputer dictionary. We couldn't prepare a page of this magazine without one —Editor

WANTS MORE APL

Dear Editor:

My brother is subscribed to your magazine in America and when he finishes reading it he normally sends it to me. I must admit that I enjoy reading it, but to an absolute beginner, 80% of it seems illegible, e.g. I have no idea what CRT or TTY stands for. Anyhow I must ask you for a favor, i.e. that you should send this postcard to one of your readers whose letter appeared in your magazine. His name is Phillip Apley, Amherst, MA, whose exact address didn't appear at the foot of his letter so I can't send him this postcard directly. His letter was about APL if it helps. Thanking you in anticipation: B. Finkelstien.

Dear Phillip:

I read your letter in INTERFACE AGE (March, 1977) and being an APL freak, I decided to answer you. I only come into contact with an APL system when I go to Bar-Ilan University. They have an APL SV there running on an IBM 360/370 (I think!) and I go down there whenever I wish to enter a program into my number, or whenever I wish to play games. The I/O is via a selectric typewriter which has a printing ratio of about 6 to 10. I have as yet no micro/minicomputer equipment but I have been intrigued by the idea of having an APL system based on a mini/microcomputer. Of course, there is the IBM 5100 computer that has APL/BASIC on the same machine, but I have the unfortunate feeling that that is out of my price range. I'm afraid that I don't really have much idea of micro/minicomputers and since I'm looking for a REALLY cheap system, I was toying with the idea of using an ASCII keyboard and a pixie-converter with my T.V. set. (Incidentally, could you please find out what wave lengths are channels 2-6 on, as in Israel we only have one channel!) So could you tell me if the aforementioned combination would save me buying a terminal and monitor?

My address is on the back of the card. Please write soon and when you do write, give me your precise address as well as the computer system that you have at home. Do you have any interesting games that I could play in APL, if so try and send the programm listings if it's not too much trouble. If it is then just give me the algorithm. Thanks again!!

Bennie Finkelstien
Petach Tikva, Israel

We have forwarded a copy of your postcard to Phillip Apley. Hope you two can get some correspondence going. —*Editor*

BUG

Dear Editor:

It appears that there is a typographical error in your article on the TRS-80 Microcomputer System (p. 62, Sept. 1977). If each cell is divided into a 2 × 3 graphic character than the SET (x,y) instruction should be (x = 0-127, y = 0-47). "y" is 16 lines times 3 sections per line.

Philip L. Edelsberg
Software Systems Analyst
Chrysler Corporation
Sterling Defense Div.
Warren, MI

Thanks for catching it. —*Editor*

SOFTWARE BUG

Dear Editor:

The patch published in August to correct the "X" command for EXMON-6800 does just that. However, it creates problems with the "F" and "D" commands. The patch I have had success with follows:

1EEA	7E 1F 84
1F84	C1 58
1F86	27 03
1F88	7E E0 C8
1F8B	08
1F8C	7E E0 C8
1E6C	C1 43
1E76	C1 41

William Schartz
St. Louis, MO

Dear Editor:

I just received two copies of your magazine from a friend of mine. I must admit I never heard of INTERFACE AGE until then. (A little advertising wouldn't hurt.) However, I am sure I will be hearing much in the future because you have the makings of a great computer magazine.

I would like to see a Floppy ROM that has 4K BASIC for an 8080 base system.

Also your Hardware Feature that examined the S-100 bus structure was great. It was the first time I ever saw the S-100 bus described completely.

Even though I work at Fairchild where we make the F8's I'm designing my own 8080 base system which brings me to my last point. I would like to see other things in your magazine besides disc interfaces, simulators, etc. I'd like to see some simple but expandable computer systems using the 8080, 6800 and other microprocessors.

How about an article on how to take some 2102 RAMs and building your own 2 or 4 or 8K RAM? How about some video terminal circuits?

Keep up the good work and thank you for your time.

Joseph Cacciatore
Poughkeepsie, NY

Readers, how about taking up the suggestion in this chap's last paragraph? —*Editor*

Dear Editor:

I recently got a KIM 1 computer. One of the first things I put in it was the clock program on page 36 of the KIM 1 Sidereal/Solar Clock article appearing in the August issue. It unfortunately did not work as it stopped at midnight (2400) when set for 24-hour operation. I did not try to make it run with 12-hour operation.

After several days of trying, I found that if I changed the BEQ (f 064) starting at address 024A to JMP (4C 00 02), it would then run continuously.

Donald J. Johnson
Carlsbad, CA

Thanks for sharing this with our readers. —*Editor*

FLOPPY ROM LETTERS

Dear Editor:

Re: Floppy-ROM. BRAVO! Received May issue today, and loaded up the Floppy-ROM to my SWTPC computer, via transcription to cassette and reading via AC-30 interface. Beautiful. Have been using this version of RKU's BASIC for an engineering application — a distillation calculation. Was able to load up this BASIC program with no trouble.

Have a 118 character terminal; you may wish to pass on that length of the line formed by the BASIC can be changed from 88 characters to whatever, by changing location $0D15 from $30 to the line length, in my case $76. I have about 2 hours invested in this information!

G. Treune
Lewiston, NY

Dear Editor:

Congratulations on your fine "Floppy-ROM" effort. In my thinking it is quite an accomplishment and I would like to send my thoughts.

In order to test your new idea among a large group of enthusiasts, you naturally chose one of the largest groups of users — those with a 6800 μP and with the ability to read data in the "Kansas City" format. Probably SWTP owners are the largest subset of this group.

This should give you plenty of feedback from a group with the *least* need for a 4K BASIC. It is ironic that the people who can most easily read your record already have readily available a 4K BASIC, 8K BASIC, Text Editor, Assembler, etc.

I own an MOS Technology KIM-1 System based on the 6502. I'd love to have a 4K BASIC published in your magazine. I'd even be willing to key it into my computer the first time, after which I could make my own tape. But I understand that there probably aren't enough KIM owners reading INTERFACE AGE to justify the effort for you.

So my conclusion is one of mixed feelings. Your 4K BASIC is a great idea but *no one who can use it really needs it,* and *no one who really needs it can use it.*

R. W. Eyler
Ann Arbor, MI

Dear Editor:

My first experiment was to dub, four times directly from the Floppy-ROM to a Scotch "Master Tape 60." This was done in our production studio at Radio Station WTTF.

Turntable: Rek-O-kut L-34; Tone arm: Gates; Stilas: Shure M44-7; Preamp: Ramko-SP-8; Audio Console: Spotmaster 4 BEM-50; Cassette machine: Sony TC-180; Production equipment characteristics: tone arm adjusted to 4 grams, turntable speed within .5%, preamp phase corrected for vertical noise. System frequence response ± 1 dB from 50 Hz to 15,000 Hz. Hum and noise better than -60dB.

INTERFACE AGE and the Floppy-ROM arrived in good condition (better than usual). I noted that the record was cut at a level which allowed all controls to be adjusted to midrange for OVU. (Both the console and cassette are metered).

My computer system includes: SWTP 6800 with 12k RAM. AC-30 cassette interface and two Sanyo machines. CT 1204 terminal and Shabaden monitor.

All four cuts, recorded on cassette, loaded into my 6800 flawlessly and no adjustment ot the AC-30 was found necessary.

My second experiment was an attempt to load directly from my Panasonic component stereo system into the AC-30. I was successful on the 5th and 6th tries. I first tried to load from the speaker jack but found too much noise at low output level. Rather than pad the output from the speaker jack, I tried one side of the stereo headphone jack. By cutting the base all the way and boosting the trebel ¾, I obtained a clean load. Unfortunately, I had to run the speaker level very high which brought my next door neighbor on the run. My neighbor is the chief programmer at a local machine company who had never heard of a personal computer. I've owned my own system for six months now and for some unknown reason had never mentioned it to him. Well, after spending the day with my system, he is really hooked and you have a new subscriber. I guess it pays to advertise, so send a copy of the Floppy-ROM to your local radio station.

On my third attempt to adjust my Panasonic I put a scratch across the calibration track. This causes a drop-out on every revolution. Fortunately the BASIC is still intact. Under the best of conditions the Floppy-ROM worked flawlessly.

Feel free to send a 6800 program on Floppy-ROM along with the magazine anytime. Thanks for the 4K BASIC and good luck.

Richard Wright
Tiffin, Ohio

Dear Editor:

I had no problem loading the record (via cassette) and getting the binary loader into memory, since I have a MIKBUG-compatible loader. However, since I didn't have a MIKBUG listing, most of your MIKBUG calls in the loader were a mystery to me. After awhile I figured out the format and wrote my own loader. I was then able to read in BASIC.

I then wrote a small program to display all the bytes containing A0, E0 or E1 to find all the MIKBUG calls and stack references, which I proceeded to patch for my own system. Two MIKBUG calls (E0BF and E0C8) were new to me; after asking around at work I was able to get a MIKBUG listing which solved my problems. I also discovered that by modifying locations 44-45 I could tell BASIC where I wanted it to think my memory stopped; this allows me to keep my operating system resident in high memory.

I think the Floppy-ROM is a great way to distribute software in computer-hobbyist magazines - sure can't complain about getting BASIC for $1.50 (though it would be nice if it had string capabilities . . .)

In the future, please provide a *little* more documentation. For example, in the present issue (May, 1977) your BILOAD program is completely uncommented (page 33). And simply telling users that don't have MIKBUG that they'll have to do a lot

of patching isn't much help when you don't even list the routines in MIKBUG that are called and what they are supposed to do. I was just lucky to get hold of a MIKBUG listing or my BASIC would not be working. Finally, there was no information on the "USER" function (page 52) — what are the register and calling conventions? I had enough fun getting LOAD and SAVE to work with my cassette system (the commands have circular definitions in the article).

Good first try though; you seem to have the bugs out of the record-pressing end of things.

Tom Crosley
Sunnyvale, CA

Dear Editor:

I had generally good luck with the 6800 BASIC "Floppy-ROM." The program loaded the first time as well as I was ever able to get it to load. There appears to have been a defect in the header for the data block 0B00-0BFF on my record, and this particular block would never load, so it was entered by hand. Everything else, including the test patterns and the rest of the program loaded the first time I tried.

Using a block length of 256 bytes is too long. It makes for too much lost data when there is a problem, or too much data to search through when there is a load error that has to be corrected by hand. A block length of 16, 32, or 64 bytes would be more appropriate.

Since I had to write my own loader, a discussion of your binary block format would have also been nice.

If you are going to release software into the public domain, it would be nice to also provide some documentation on the program, such as the location of the I/O subroutine calls, and other calls external to the program. Better yet would be following the software design conventions as discussed by Tom Pittman in a recent issue of "Dr. Dobb's." I realize that SWTPC is not in the business of writing software for other manufacturers' machine, but you can always hope for better software and documentation.

Graham Haddock
Hayward, CA

Dear Editor:

Love the idea — it occurred to me when Byte first published their "Paperbyte" proposal. Tried it and got good 'scope waveforms using a Shure V-15/SME arm wired for mono — my systems are homebrew SC/MP and an Altair 8800b so am looking forward to the next (8080) offering which I will try to load into my Altair.

Happy (digital) recording.

R. Patterson
Montreal, Quebec

UPDATE

COULD YOUR COMPUTER SEND YOU TO PRISON?

How can privacy protection be built into data processing systems while still allowing a free flow of information? What is the key to understanding government regulations that inflict penalties for withholding certain data from the public yet provide strong measures against the improper disclosure of data? These and numerous other questions will be answered during the briefing, "Privacy Regulation: Implications for the Business Community," which will be presented by the Center for Management Development of American Management Associations, October 17-19. The meeting will be held at the American Hotel in New York City.

Co-chairmen of the meeting will be Alfred Walker, Personnel Manager, AT&T, and Dr. Alan Westin, Professor of Public Law and Government, Columbia University. Among the 28 speakers will be Edward Koch, New York City Congressman and candidate for Mayor; David Linowes, Chairman, The Privacy Protection Study Commission; Dr. G.H. Collings, Jr., General Medical Director, New York Telephone; Donald Dewey, Program Manager, Personnel Information, IBM; Christopher Heller, President's Reorganization Project, Office of Management and Budget, and Aryeh Neier, Executive Director, American Civil Liberties Union.

For registration and further information, contact American Management Association, 135 West 50th Street, New York, NY 10020, (212) 586-8100.

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The Retail Computer Dealer's Association has now been formed and offers the following excellent set of services to the retail dealers, such as group hospitalization insurance plan; group life insurance plan; group disability insurance plan; group retirement pension plan jointly administered by a neutral non-participating third party and the United California Bank as co-trustees.

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CALL FOR PAPERS

A call for papers has been issued for the Eighth International Symposium on Multiple-Valued Logic, which will be held May 24-26, 1978, in Chicago. The event is co-sponsored by the IEEE Computer Society, the Illinois Institute of Technology, the Office of Naval Research and the ACM. Authors are invited to submit original unpublished research, survey, or tutorial papers on the theory and applications of multiple-valued logic in the following areas: algebraic and formal aspects of multiple-valued logic; logic design and switching theory; probabilistic, variable-valued, and other multiple-valued systems; automated design; languages and language processing; applications in exact reasoning to knowledge based systems; programming logic and man/machine systems; circuit implementations; philosophic aspects; fault detection and diagnosis, and reliable design; applications in digital systems; and other relevant topics of interest.

Both regular and short papers are solicited. Authors of regular papers should submit four copies of a 50-100 word abstract as well as a full draft with figures (typed double-spaced and not to exceed 20 pages). Authors of short papers should submit two copies of a summary (no more than 500 words, typed double-spaced). All material is due *December 16, 1977,* and should be mailed to Dr. Robert E. Swartout, program chairman, Electrical Engineering Department, West Virginia University, Morgantown, West Virginia 26506; (304) 293-3880. An award of $100 will be given to the author of the best regular paper in terms of technical contribution, clarity, and quality of presentation.

CALENDAR

NOVEMBER

Nov 2 New England Computer Society will meet in the cafeteria of the MITRE Corp. at 7:00 P.M. Located on Route 62 in Bedford, MA. Contact Dave Day at (603) 434-4239 for details.

Nov 2 Kitchener Waterloo Microcomputer Club will meet at the University of Waterloo, Room 3388, Engineering Bldg. #4, University Ave., Waterloo, Ontario, Canada at 7 P.M.

Nov 2 Northwest Computer Society will meet in the Regional Astronomy Education Laboratory Auditorium, Room 200 at 7 P.M. For further details write: NCCN, Box 242, Renton, WA 98055.

Nov 2 The Valley Computer Club will meet at the Harvard School at 7 P.M. The Harvard School is located at 3700 Coldwater Canyon, Studio City, CA.

Nov 3 Bay Area Microprocessors Users Group (BAMUG) will meet in the Hayward ROC Center, 26316 Hesperian Blvd., Hayward, CA at 7:30 P.M. For further details write BAMUG, 1211 Santa Clara Avenue, Alameda, CA 94501.

Nov 4 Crescent City Computer Club will hold its meeting at the University of New Orleans, Lakefront Campus at 8 P.M. Call Bob Latham at (504) 722-6321 for more details.

Nov 5 Louisville Area Computer Club will meet in the Speed Auditorium at the University of Louisville at 1:00 P.M. For further information, please write Louisville Area Computer Club, 115 Edgemont Dr., New Alban, IN 47150.

Nov 5 Southern Nevada Personal Computing Society will meet at Clark County Community College, Las Vegas, NV at 12:00. For further information write SNPCS, 1405 Lucille St., Las Vegas, NV 89101 or call (702) 642-0212.

Nov 5 The Computer Hobbyist Group, will meet at 1:00 P.M. in Green Center, Room 2.530, campus of University of Texas, Dallas. For more information write: The Computer Hobbyist Group, P.O. Box 11344, Grand Prairie, TX 75051.

Nov 5 South Central Kansas Amateur Computer Association, 9:00 A.M., Wichita Public Library, Wichita, KS. For further information call Chris Borger at (316) 265-1120 or Dave Rawson, 1825 Gary, Wichita, KS 67219, (316) 744-1629 for further details.

Nov 5 Oklahoma Computer Club will hold its meeting at the Belle Aisle Library at 10:00 A.M. Call Al Campbell at (405) 842-4933 for details.

Nov 5 Milwaukee Area Computer Club will meet at 1 P.M. at the Waukesha County Technical Institute, New Berlin, WI. Call (414) 246-6634 for further details.

Nov 7 Minnesota Computer Society will meet at the Brown Institute, Room 51, 3123 E. Lake Street, Minneapolis, MN. For further information write this address.

Nov 10 Utah Computer Association will meet at Murray High School, Rm 154, 5440 S. State St., Salt Lake City, UT at 7:00 P.M. For further information write or call Larry or Holly Barney, 1928 S. 2600 E., Salt Lake City, UT 84108. (801) 485-3476.

Nov 10 Mid America Computer Hobbyist meeting will be at 7:00 P.M. at Commercial Federal Savings and Loan, Bellevue NE. Intersection of Galvin Rd. and U.S. Hwy. 73-75. Write P.O. Box 13303, Omaha, NE 68113 for further information.

Nov 10 The Rochester Area Microcomputer Society will meet at the RIT Campus, Rm. 1030, Bldg. 9 at 7:30 P.M. For further details write RAMS, P.O. Box D, Rochester, NY 14609.

Nov 11 Northern New Jersey Amateur Computer Club (NNJACC) will hold its meeting at the Fairleigh Dickenson University, on the Rutherford Campus, Becton Hall, Room B8. This meeting will begin at 7:00 P.M. For more information contact NNJACC, 593 New York Avenue, Lyndhurst, NJ 07071.

Nov 12 The Permian Basin Computer Group — Odessa Chapter meets at 1 P.M. in the Electronic Technology Bldg., Room 203 on the Odessa College campus. For further information call (915) 332-9151.

Nov 13 North Orange County Computer Club will have its meeting at Chapman College, Orange, CA. Doors open at 12:00. 105 Hashinger Hall Auditorium. Membership Chairman, Tracey Lerocker, (714) 998-9722 evenings.

Nov 16 Homebrew Computer Club meeting will begin at 7 P.M. in Menlo Park, CA. The Stanford Linear Accelerator Center Auditorium is the site of the meeting. Call (415) 967-6754 for details.

Nov 18 Long Island Computer Association will meet at the New York Institute of Technology, Old Westbury Campus, Route 25A between Route 107 and Glen Cove Rd., Rm. 508. The time of the meeting is 7 P.M. For further information, write Long Island Computer Association, 36 Irene Lane East, Plainview, NY 11803.

Nov 18 TRACE will hold its meeting at the Ontario Science Center, 2:00 P.M., 770 Don Mills Road, Don Mills, Ontario. Club address is Box 545, Streetsville, Ontario, Canada L5M 2C1.

Nov 19 San Diego Computer Society will meet at the Grossmont Community College Student Center, 8800 Grossmont College Dr., El Cajon, CA. Doors open at 12:30. For details call (714) 565-1738.

Nov 19 The 7C's Committee (Affiliated with the Cleveland Digital Group) will meet at Cleveland State University Student Services Bldg., in the Kiva Room at 2:00 P.M. For more information write to Cleveland Digital Group, 8700 Harvard Ave., Cleveland, OH 44105.

Nov 20 Central Florida Computer Club will meet at the Orlando Utility Bldg., on S. Orange Ave., Orlando, FL at 2:00 P.M.

Nov 20 Chicago Area Computer Hobbyist Exchange (CACHE) will meet at 12:00 P.M. in the Nigas Bldg. Cafeteria. The Nigas Bldg. is located on Schermer Rd. in Glenview, IL. Call CACHE Hotline (312) 849-1132 for details.

Nov 22 Sacramento Microcomputer Users Group, (SMUG), 7:30-9:30 P.M. at SMUD Training Bldg., 59 St. between Folsom and "S" Sts. Write Richard Lerseth, P.O. Box 161513 or call (916) 381-0335 after 5:00 P.M.

Nov 23 Diablo Professional Users Group (DPUG) will meet at Diablo Valley College Library, from 8-10 P.M. DVC is near the Willow Pass exit of Fwy. 680. For details write or call Bob Hendrickson, Electronics Dept., DVC, Pleasant Hill, CA 94523; (415) 687-8373.

Nov 24 Small Computer Engineering Association of Minnesota (SCEAM) will meet at the Resource Access Center, 3010 Fourth Ave. So., Minneapolis, MN 55408 at 7

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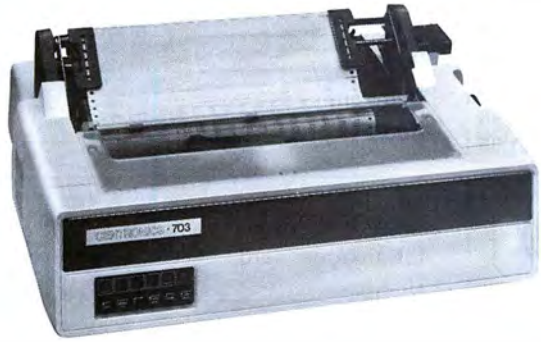

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Nov 24 Space Coast Microcomputer Club will meet at 7:30 P.M. at the Merritt Island Library, Merritt Island, FL. Call Ray Lockwood at (305) 452-2159 for details.

Nov 25 University of Minnesota Microcomputer Users Group (UMMUG) will hold its meeting at the University of Minnesota, Electrical Eng. Rm. 115 at 7 P.M. For further information write UMMUG, Dept. of Elec. Eng., 123 Church St. S.E., Minneapolis, MN 55455.

Nov 25 Alamo Computer Enthusiast meets at 7:30 P.M. in Rm. 104 at Chapman Graduate Center at Trinity University, San Antonio, TX. For details call (512) 532-2340, or write to the club at 7517 Jonquill, San Antonio, TX 78233.

Nov 25 Washington Amateur Computer Society has scheduled its meeting to be held at the Catholic University of America, St. Johns Hall. Located at Michigan and Harewood Aves. in Washington, D.C. Contact Bill Stewart at (202) 722-0210 for club details between the hours of 10 A.M. and 12 P.M.

Nov 27 Birmingham Microprocessor Group will meet at Southcentral Bell Company headquarters bldg. at 2 P.M. For further details write or call Jim Anderson, 2931 Balmoral Rd., Birmingham, AL 35223; (205) 897-9630.

Nov 27 Summit City Computer Club will meet at the McMillen Library on the Indiana Institute of Technology Campus in Fort Wayne, IN. For further information write the club at P.O. Box 5096, Fort Wayne, IN 46805.

DECEMBER

Dec 1 Bay Area Microprocessors Users Group (BAMUG) will meet in the Hayward ROC Center, 26316 Hesperian Blvd., Hayward, CA at 7:30 P.M. For further details write BAMUG, 1211 Santa Clara Avenue, Alameda, CA 94501.

Dec 3 Louisville Area Computer Club (LACE) will meet at the University of Louisville, Speed School Auditorium at 1 P.M. For further information, write the club at 115 Edgemont Drive, New Alban, IN 47150.

Dec 5 Minnesota Computer Society, TCTH, 7:30 P.M., Brown Institute, Room 51, 3123 E. Lake St., Minneapolis, MN. Contact the club for more information.

Dec 7 Northwest Computer Society will meet in the Regional Astronomy Education Laboratory Auditorium, Rm. 200 at 7 P.M.

CALL FOR ARTICLES

We are actively seeking articles in hardware, software and general applications of microcomputers in industrial, business, science, medicine and personal fields.

Articles authored by individuals during leisure time are remunerated at a rate from $15.00 to $50.00 per published page and articles describing company projects carry author and company byline, but no honorarium is offered. Articles accepted will be acknowledged with a binder check within thirty days of receipt.

Manuscripts should be double-spaced, typewritten pages, one inch margins, and not less than 3½ pages in length (one published page). Pages should be numbered to insure correct text. Photographs should be numbered and labeled on the backside with a description. Tables, listings, etc., shall be on separate sheets. Photos should be taken with uniform lighting and background, in the form of glossy black and white prints. Computer listings shall be printed using a new ribbon to assure darkest print copy. Authors shall supply a statement of their background, expertise and level of accomplishment.

The publisher assumes no responsibility for artwork, photos, models, or manuscripts. Manuscripts are not acknowledged or returned unless accompanied by an addressed, stamped, return envelope.

For article submittal or further information, contact Linda Folkard-Stengel, Feature Editor, INTERFACE AGE Magazine, 13913 Artesia Boulevard, Cerritos, CA 90701 or call (213) 926-6629.

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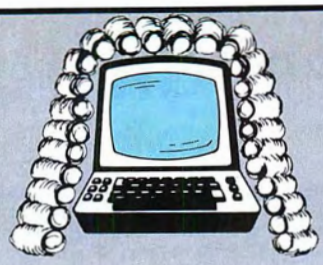

THE JURISPRUDENT COMPUTERIST

By Elliott MacLennan, J.D.
Stephen Murtha

DISC (Domestic International Sales Corporation): The Non-Floppy Approach to Saving Taxes

Going international? If your company has been receiving sales orders or inquiries from abroad, you may be experiencing the initial wave of the international export phenomena in small, personal, and hobby computers.

Many domestic firms in the United States are receiving requests for product information and substantial purchase orders from international sources, especially foreign distributors.

Several factors interplay to produce this interest, two of which should be singled out: 1) Deficient manufacturing capabilities, and 2) Lack of trade publications in the respective foreign language.

What this article will discuss is the Domestic International Sales Corporation (DISC) and how it can defer up to 50% of the federal income tax on export.

History: Historically, the DISC owes its existence to the 1971 Revenue Act. This legislation was a product of the Nixon Administration's attempt to improve the United States balance of payments position. The 50% tax deferral, among other tax incentives, was designed to improve the competitive position of U.S. exporters.

Formation: Before discussing the specific tax benefits available, let's first proceed to a definition of the component parts of a DISC.

- It must be a domestic corporation that elects to be taxed as a DISC.
- It must have only one class of stock with a capital value of no less than $2,500 on each day of the year.
- At least 95% of its assets must be "qualified export assets" which, for simplicity, can be described as those assets which a DISC holds in order to perform its export activities.
- At least 95% of its gross receipts must consist of "qualified export receipts." These receipts must arise from export sale or lease transactions and other export-related investments or activities.

In summary, once an election is made, with a small capital funding requirement where the exported items (basically U.S. made products being shipped abroad) produce the income, you are in business.

A DISC is a classic but legitimate paper dummy corporation. Usually an incorporated company sets up a DISC by forming another corporation using the same officers, officers, directors, clerical help, and employees. All domestic products the company processes for export are handled by the DISC.

Taxation: Assume the DISC is in operation and it is receiving income from foreign export activity. The shareholders or owners of the DISC are taxed, *not* the DISC itself. Fifty percent of the profit on export activity is "deemed" distributed to the shareholders. This "deemed" or legislative distribution is important because the DISC (or more correctly its shareholders) is taxed only upon a distribution. The remaining 50% profit is deferred as long as it is loaned back to the parent company. Such a loan is called a "producer's loan," and it must be designated as such at its inception. This loan can only be used to increase inventory, plant machinery and equipment, and research and development expenditures in the United States.

It should be noted that in addition to the tax incentives created by the DISC, the borrower (parent company) is allowed an interest deduction for the interest paid to the DISC for the producer's loan. The interest received by the DISC is again "deemed" distributed or not deferred. The result is that the loan transaction is a "wash" on the borrowing parent's tax return.

Intercompany Pricing Rules: An indirect but nevertheless additional economic incentive for operating as a DISC is the Intercompany Pricing rules. In essence, the parent "marks up" the price of the items manufactured for DISC exports.

The Internal Revenue Code test requires the price charged by the parent to be an "arm's-length price." (For example, the price at which the parent company would sell to an unrelated company.)

This test is complex. A company must "price" its products *during* the taxable year. The exception to this is the DISC.

The DISC provides two mechanical "safe-haven" tests which, when complied with, avoid the collapse of the intercompany pricing transaction by the Internal Revenue Service.

More importantly, however, the DISC can wait until *after* the close of the tax year to decide which of the two pricing formulas produces the highest allowable profit. In summary, the DISC has been legislatively granted the power of hindsight.

Tax Pitfalls: As noted previously, shareholders are generally taxed on the deferred portion of DISC income when it is actually distributed to them. There are also three special situations in which DISC shareholders will be taxed even though in-

come is not distributed to them.

DEEMED DISTRIBUTIONS: Deemed distributions include income not arising from export activity. An example of this would be interest paid to a DISC from its parent.

The 50% of the DISC income which is *not* deferred is "deemed" distributed to DISC shareholders.

A "deemed" distribution also occurs when deferred DISC income is invested abroad; for example, to build a foreign plant. This is called the "fugitive capital" limitation.

DEEMED DISTRIBUTIONS WHERE A CORPORATION NO LONGER QUALIFIES AS A DISC: The previously deferred DISC income is recaptured (taxed) over a period not exceeding 10 years.

DISPOSITION OF DISC STOCK: Unlike other corporations, when DISC stock is sold it is taxed at ordinary income rates as opposed to receiving the more favorable capital gains treatment.

Filing of Tax Return: DISC tax returns are not due until the 15th day of the 9th month following the close of the taxable year. This provision is unquestionably more liberal than the present treatment of individuals or non-DISC corporations.

By placing the DISC on a different tax year than the parent, income generated from the same manufacturing facility can be spread into different tax years with the overall effect of lowering the parent's and DISC shareholder's income tax.

Recent Legislation: The 1976 Tax Reform Act ushered in a curtailment of certain DISC tax incentives. Congress concluded that, on the whole, DISC's have had a beneficial impact on U.S. exports, but it was concerned with the revenue cost of the DISC program.

Accordingly, the tax deferral is limited to an *increase* in export activity over the base computational years of 1972-1975.

Two exceptions of critical importance should be noted. First, if your company has never exported its products, there is no increase in export activity. Therefore, the full 50% tax deferral on DISC profits is available to you. Second, Congress saw fit to exempt "small DISC's" (less than $100,000 income in one year) from the deferral limitation entirely. Therefore the full 50% deferral is available even though in 1972-1975 your company had substantial export activity.

Conclusion: The DISC will be an advantage to most corporations engaged in the export business. The advantages may be summarized as follows:

1. Deferral of tax on 50% of income.
2. Taxation only at shareholder level.
3. Accounting treatment which may allow tax savings to be reflected in earnings.
4. Alternative methods of allocating income between a DISC and its parent.
5. Convenience of operating through domestic instead of foreign subsidiaries and distributors.

Two disadvantages must also be considered:

1. Strict technical rules must be met, and
2. No exemption provided for state taxes.

"How much can you give me on that trade-in?"

Some people build personal computers for the love of building. And the systems they buy are usually more fun to build than to operate.

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The Equinox I/O Interface is a single board that plugs right into your Equinox 100™ bus. And you're ready to plug in 3 audio cassette units with individual motion control, a Teletype* or RS-232 terminal, and any 8-bit parallel device. . . including graphics display, line printer or paper tape reader.

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THE EQUIN

LL THER W!

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EQU/ATE is also an extraordinary text editor which works interactively with you to edit by character, string or line. It also offers full number editing of memory contents in octal, hex or decimal.

Yet, EQU/ATE is extremely compact, occupying only 4K of memory with 8K total memory required.

BASIC-EQ is a powerful, interactive, high-level programming language developed for math and science applications. Its primary use is in the manipulation of numbers, although it is capable of string oriented operation. Our version, BASIC-EQ, occupies 5K of memory.

Both BASIC-EQ and EQU/ATE are supplied on cassette, ready to load themselves into your Equinox System ™. They are competitively priced. . .and are even more attractive when purchased together with your Equinox System ™.

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IN PERSON — **See The Equinox System ™ at your local computer shop.**

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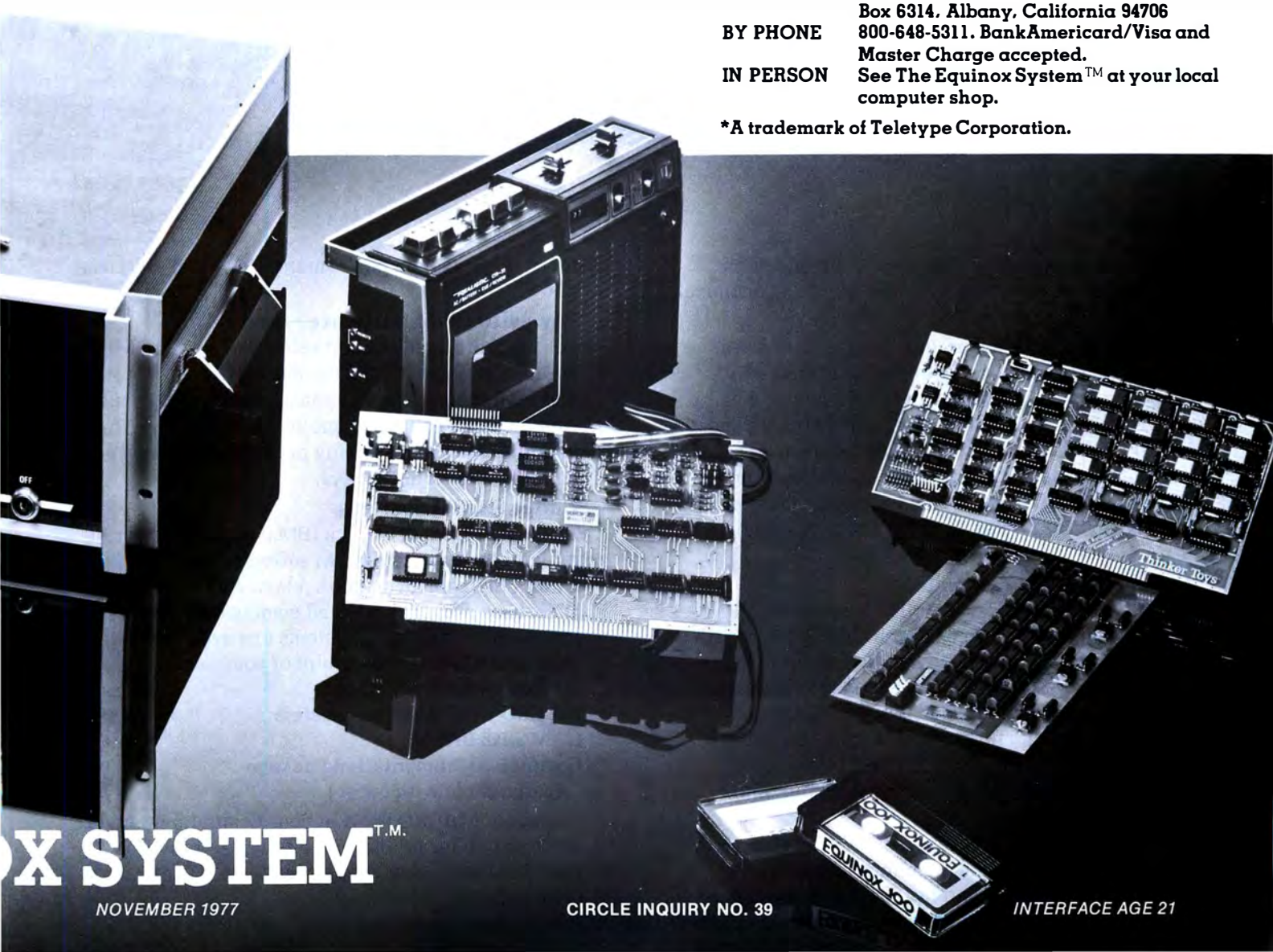
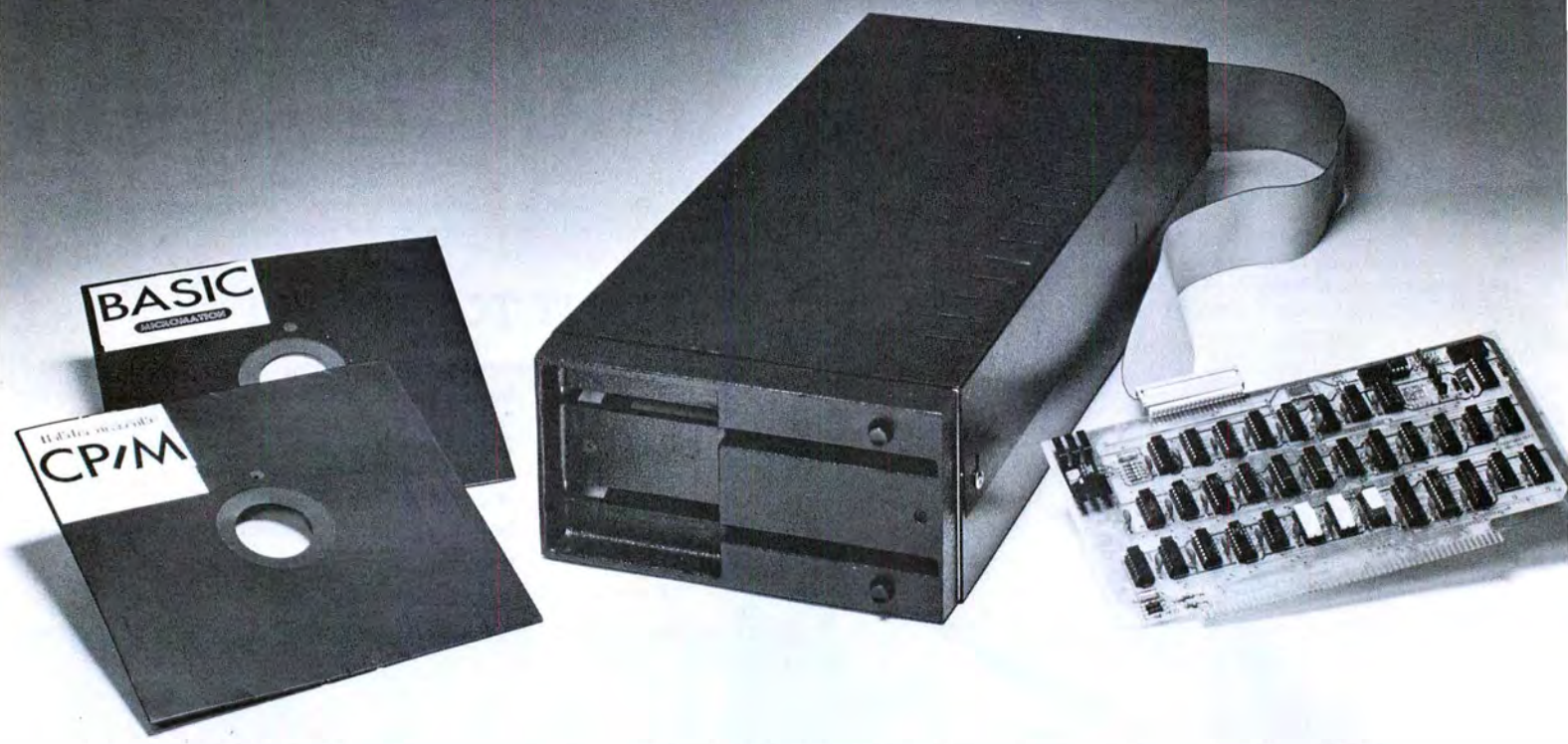


X SYSTEM T.M.

The High Performance Floppy Disk System That's Not High Priced



Micromation's MACRO DISK is a complete, high performance floppy disk system—yet it's economical.

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MACRO DISK uses the unique Per-Sci dual drive to give you the fastest, most reliable system available. This unique drive features a fast voice coil positioner and automatic electronic diskette handling. It's a field-tested design that's proven its reliability and superiority in years of operation. And its a full-sized dual drive—you have on-line mass storage of over 500K Bytes, and you can copy diskettes to provide essential system backup.

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The Micromation disk controller features full IBM 3740 formating—so you can interchange disks with the rest of the world. There's even a serial I/O port on the controller board to make it easy to bring the system up. Just connect your terminal to the controller's serial interface, install in any 16K S-100 system, jump to the on-board PROM bootstrap—and you're up and running without any patching.

A Complete, Assembled System

MACRO DISK is fully assembled and tested. And it's complete—including aluminum enclosure, cables, power supply, and fan. Everything you need to bring big system performance to your S-100 computer.

Powerful CP/M Software—and BASIC

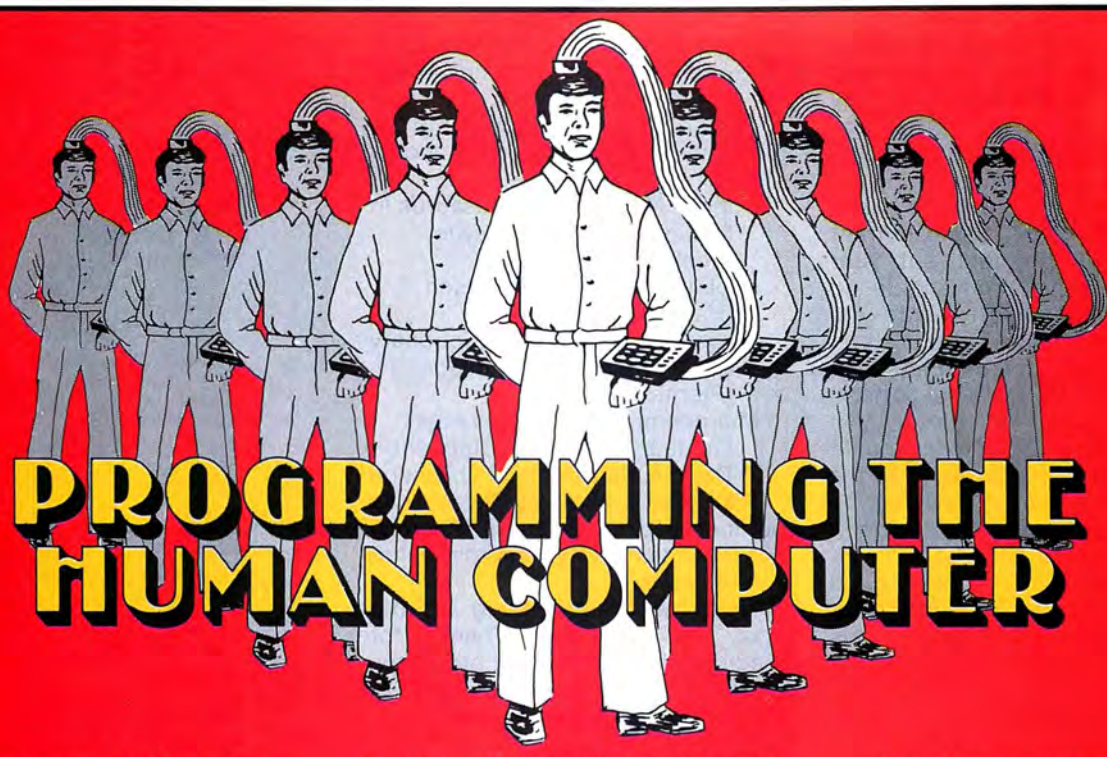
For program development select the optional Micromation version of CP/M, the most powerful floppy disk operating system available for microcomputers. And there's BASIC. A complete disk BASIC featuring: versatile file access; string processing; and both numeric and string arrays.

Under $2,000 Systems

The fast Per-Sci drive, the IBM compatible controller, and the powerful CP/M software make MACRO DISK a high performance system. And since MACRO DISK uses proven, standard components, there's no long wait for delivery. Systems are available in less than four weeks from receipt of your order. But the best news is the price.

MACRO DISK dual Disk system	**$1,895.**
CP/M with BASIC	**95.**
Complete Documentation Package (refundable with order)	**35.**

Ask about MACRO DISK at your computer store, or write or call for additional details. Micromation Inc., 524 Union, San Francisco, Ca. 94133, (415) 398-0289.



PROGRAMMING THE HUMAN COMPUTER

HOW TO WRITE AN ARTICLE PART 2

Last month we looked at some of the basics of article writing. I suggested 12 steps you can use in your article writing. These steps are:

1. Make a list of topics and ideas.
2. Write a rough outline.
3. Write a good outline.
4. Write a rough draft.
5. Revise the rough draft.
6. Write the second draft.
7. Do a line by line revision.
8. Write and type the final draft.
9. Edit and revise.
10. Do a line by line revision.
11. Retype and proof the final draft.
12. Retype (if necessary); insert photographs, drawings and printouts. Submit it to the magazine.

This month we will expand some of these ideas. We will concentrate on outlines, drafts and writing for reading.

Why do you need an outline? Mainly, because it helps consolidate your thinking. Every article should have a structural design that allows you to emphasize your most important points and relate these points to one another. It also has a beginning, a middle and an end. The middle is further divided into a number of separate sections so carefully put together that each paragraph fits into only one place. There are no alternative locations for it. You can make sure this happens by creating and following an outline.

Now that you are convinced that writing an outline is necessary, where do you start? Start by keeping in mind that the outline is for your benefit only; usually no one else is going to read it. Every item on your outline should be a key that triggers creative thought. Use key words, phrases or sentences but make it meaningful. Make little notes to yourself where appropriate. For instance, you may have the key word *program*. Next to it you might write: *use assembly language — explain why.*

If the purpose of writing an outline is to give your article a basic structure, then it follows that your outline should have a structure. This one works:

I. Main idea
  A. Key subject
    1. topic
    2. topic
  B. Key subject
II. Main idea

The advantage of using this kind of an outline is that it shows you exactly where you are going. As an example, here is my outline for this article:

I. Basic of article writing
  A. 12 steps
  B. What we are going to do
    1. outline
    2. drafts
    3. thought about writing
    4. reference sources
II. Outlines
  A. Purpose
    1. Consolidate thinking
    2. Logical organization of thought
  B. Some basic principles
    1. The key that triggers thought
    2. Structure and why
  C. Outline of this column
III. Importance of drafts
  A. Why more than one
  B. Editing and revising (reference sources)
IV. Some thoughts about writing
  A. Putting it together
    1. Logical organization of thought
    2. Clarity is the primary goal
    3. Things to do
      a. Specific detail
      b. Examples
      c. Drawings or photos
  B. Sentences
    1. Short, clear and well constructed
    2. Single ideas
  C. Say what you have to say in the clearest possible manner
    1. When cogitating . . .
    2. Other words, keep it simple (KISS)
  D. The reader
    1. Know the reader
    2. Keep the reader in mind
    3. Inform him
V. Reference Sources
  A. Dictionary
  B. Thesaurus
  C. Look It Up
  D. Sippl/Kidd

See if you can relate this outline to the article. Can you write a better one? Can you see the structure? One way to learn how to outline is to make outlines of what you read. Try writing an outline of some of the other articles in this magazine. Ask yourself how your outline could improve the article. Outlining is part of the basic workmanship that goes into good writing and the only way to learn it is to practice.

Once you have a good outline, you are ready to start your rough draft. You can either keep your outline on

hand for reference or you can read it and put it aside. I believe putting it aside is the best method; but try both. No matter how you use the outline, it should serve as the structure for your rough draft.

Your rough draft should be exactly that, rough! Don't try to correct things as you go, just put your thoughts on paper. You should go entirely through a draft before you attempt to edit or revise it. This is time-consuming and cumbersome, but it's worth it. Follow a set pattern: write, edit, revise, rewrite. If you follow this pattern your work should hang together. This leads us to the most important part of revising: be *vicious*. Cut out everything that isn't clear, concise and necessary.

Clarity is the primary goal of good writing, so try to organize your thoughts in a logical manner. This can best be done by remembering these rules:

1. Follow your outline.
2. Explain things carefully.
3. Give examples.
4. Be specific.
5. Remember your reader.
6. Include drawings, photographs or programs to amplify your comments.
7. Write short, clear, well-constructed sentences.
8. Restrict each sentence to a single idea.

And most importantly . . . *when cogitating about indicting a treatise, one is obliged to pursue an elementary prescript: eschew obfuscation.* In other words, keep it simple. Always keep your reader in mind. Remember, your purpose is to inform or educate your reader, so write to him in the same way you would talk to a friend.

There is much more I should say about the techniques of writing but let's not overdo it. Instead, let's take a quick look at reference sources. Obviously, you need technical sources, but you should also have a few language sources. Before I give you a list of suggested books, I would like to comment on two of them. The thesaurus will give you words you can use. For instance, suppose you want to use the word *program* but you don't want to refer to a computer program. The thesaurus will give you these alternatives: agendum, procedure (plan), schedule, bulletin, calendar (list).

As your thesaurus will give you words, LOOK IT UP will give ideas and usage. Here are some examples:

compute — Don't use compute when figure will do.

moo, mooed mooing.

program, programmed, programmer, programming. Double m in all forms except program.

debug. Listed as standard usage in Webster's.

The books I am listing below are generally available at most bookstores.

Roget's New Pocket Thesaurus in Dictionary Form by Lewis (Pocket Books)

Look It Up by Rudolf Flesch (Harper & Row)

Webster's New World Dictionary of The American Language (Prentice-Hall)

Microcomputer Dictionary and Guide by Charles J. Sippl and David A. Kidd (Matrix Publishers)

Well, that's about it. Please use outlines and rough drafts. Remember, you can always improve what you've written.

Next month something a little crazy for Christmas. Thanks for reading this far, but don't stop now. Read on to what the editors of INTERFACE AGE Magazine require.

EDITOR'S REPLY

We are actively seeking articles in hardware, software and general applications of microcomputers in industrial, business, science, medicine and personal fields.

Articles authored by individuals during leisure time are remunerated at a rate from $15.00 to $50.00 per published page and articles describing company projects carry author and company byline, but no honorarium is offered. Articles accepted will be acknowledged with a binder check within thirty days of receipt.

Manuscripts should be double-spaced, typewritten pages, one inch margins, and not less than three and one-half (3½) pages in length (one published page). Pages should be numbered to insure correct text. Photographs should be numbered and labeled on the backside with a description. Tables, listings, etc., shall be on separate sheets. Photos should be taken with uniform lighting and background, in the form of glossy black and white prints. Computer listings shall be printed using a new ribbon to assure darkest print copy. Authors shall supply a statement of their background, expertise and level of accomplishment.

The publisher assumes no responsibility for artwork, photos, models, or manuscripts. Manuscripts are not acknowledged or returned unless accompanied by an addressed, stamped, return envelope.

For article submittal or further information, contact Linda Folkard-Stengel, Feature Editor, INTERFACE AGE Magazine, 13913 Artesia Blvd., Cerritos, CA 90701 or call (213) 926-6629.

ON LINE

50 TO 1000 MEGABYTES

HARD DISK SUBSYSTEM

Introducing the AM-400—an S-100 compatible hard disk pack storage group that ranges from 50 to over 1000 megabytes on a single controller. Average access time is 28 milliseconds for fast response for real-time manipulation of files. The controller supports up to four Calcomp Trident drives which may each contain from 25 to 300 megabytes of storage. These drives require no special environment for reliable operation with maintenance available in most parts of the United States.

LANGUAGES

The software supplied is the tested AMOS* operating system which has been in use for over five years in various systems. It is a full timesharing multi-tasking system with device independent I/O. Languages supported include AlphaBasic, *LISP, and an extensive relocatable MACRO assembly subsystem. Access of files may be sequential or random with an ISAM subsystem. The entire software package is totally compatible without modification to the existing floppy disk based AMOS* system.

COMPATIBILITY

The AM-400* subsystem may run concurrently with the AM-200* floppy disk system or it may run independently as a mass-storage device in the system. An optional IPL loader PROM is available which will sequence up the AM-400* operating system directly from the Trident disk. This PROM must reside in an independent board such as a BYTESAVER or 2708 PROM board. The IPL loader program is included for the customer wishing it in some other form of ROM storage.

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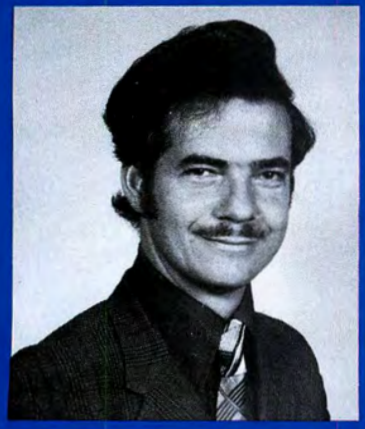
CIRCLE INQUIRY NO. 1

. . . FROM THE FOUNTAINHEAD

By Adam Osborne



The Byte Shop organization has been purchased by John Peers of Logical Machine Corporation, otherwise known as LOMAC. It has been well known in the industry that even though individual Byte Shops have been operating very successfully, the central Byte Shop organization has been under severe financial pressure and has been managed chaotically and sporadically.

John Peers is going to change all that. First of all — let me introduce you to John Peers. John has the most constructively fertile mind of any individual I have met in the computer industry. His company, LOMAC, produces ADAM, the world's first "programmerless" computer. Now, there is an element of hyperbole in calling ADAM a truly "programmerless" computer; however, it comes as close to being programmerless as any computer today. You program ADAM using English phrases and sentences which you define for yourself from a short vocabulary which is built into the computer.

John has also displayed a remarkably fertile mind when it comes to innovative advertising and marketing: the LOMAC advertising campaign is productive; it is also a welcome relief from the turgid drudgery with which we normally have to put up.

John Peers' acquisition of the Byte Shop chain will result in a number of important changes. Most important of all, John is bringing a substantial amount of cash to fund the organization adequately, and he is bringing in a team of professional managers to make sure that operations are smooth. The franchise itself will be pulled together into a more closely cooperative and centrally controlled group. This would make no sense at the moment, since individual stores are stronger than the central organization; but it will make good sense when the central organization is stronger than the stores. From the customer's point of view it means that the Byte Shops will constitute a more uniform and predictable place to find quality products and service, with recourse to a stronger organization if local problems develop. For the future it also means that the whole industry will be kept on its collective toes; John Peers has never been known to sit still for long and is likely to pop up with surprises every few weeks.

This acquisition of the Byte Shops by John Peers should make life more interesting for all of us.

* * * *

My comments regarding kits and untested parts were very timely. In the past month I have received many telephone calls, every one of which has been from a customer strenuously supporting my position. Not a single manufacturer (or user) has called to disagree. But resentment there is. At Computermania the representative of a mail order firm (who did not identify himself) told Bruce Mishkin, who works in our shipping department, that his company was angry enough not to handle our books. O.K., guys, if I am wrong, come out in the open and tell me why.

Two callers who were particularly significant because of their technical competence were Dr. Chuck Adams, who teaches microprocessor courses in Texas, and Bill Hoffer, who works for Hughes Aircraft Corporation in Los Angeles. Both of these gentlemen own a considerable amount of microcomputer equipment, and, through their friends, have direct experience with a great deal more. Both felt that microcomputer kit manufacturers are doing themselves a great disservice by indulging in unnecessarily shoddy practices.

The many phone calls I have had regarding untested parts did produce much additional interesting information.

Curiously, a number of manufacturers wanted to know what I meant by "tested" parts. I mean that individual components, when sold in kits, should be individually tested using appropriate LSI device testers which are now available from a variety of manufacturers. Boards, when sold assembled, should be tested in temperature and humidity-controlled chambers for a period of approximately three days. During this time the temperature and humidity are cycled between the specified operating limits. Simply plugging a board into a chassis and watching it work for five minutes is not good enough. The most insidious problems are the intermittent ones that arise for short periods after a board has been working for some time.

Dr. Chuck Adams, together with Dr. Stan Swanson, Frank Dunn and Brian Fisher, have written a 12K BASIC for Southwest Technical Products. They have done this free of charge. Southwest Technical Products plans to sell the BASIC for essentially the cost of the cassettes and reproduction time.

Most of the well-known names among microcomputer manufacturers have come in for shotgun criticism this past month, but a few companies were picked out as being exceptionally good, in terms of product quality, service and delivery times. Companies receiving high praise include Industrial Microcomputer Systems, SD Sales and Technical Design Labs.

A number of callers claimed that Commodore was cashing checks and not delivering the PET Home Computer. I checked with Commodore and found that they are keeping their word — scrupulously.

Everyone who gave Commodore a check was told that the check would be cashed, but that the goods might not be delivered for 90 days. If goods were not delivered in 90 days the money would be returned. Anyone who did not like the terms could simply wait until PETs showed up in computer stores where they could be purchased cash on the barrelhead. So far as I know no one has had to wait more than 90 days for their PET, and Commodore is instantly refunding money to anyone who asks for it.

I would like to be very explicit in stating that it is only dishonest or unethical practices that I plan to fight through this column; it would be unrealistic to expect the new microcomputer manufacturers to be producing flawless hardware for a totally satisfied customer base. The new microcomputer manufacturers are producing hardware that have inferior manufacturing standards as compared to traditional minicomputer manufacturers, but microcomputers built to prior high standards will cost three or four times as much. You have your choice; you can buy an inexpensive product in a computer store or you can pay a good deal more to get a better-manufactured product from a minicomputer manufacturer. The real question is this: is there a market for less expensive and less well-engineered products? Obviously there is.

To illustrate my point, consider a letter received from Mr. Darrell Rawlings; he wrote to Mr. Gary Ingram, president of Processor Technology. Mr. Rawlings complained that the power supply on his Sol 20 was defective and was replaced by a new power supply with screw holes that did not align with his chassis.

When I talked with Mr. Rawlings I found that he had bought a Sol 20 microcomputer, with cabinet and 16K bytes of RAM, for approximately $1,000.00. He could have bought an equivalent system from a minicomputer manufacturer for $2,000.00 to $3,000.00. Now, I am sure that Mr. Ingram would like to eliminate problems of the type Mr. Rawlings has encountered; Mr. Ingram would be the first to agree that a replacement power supply with misaligned screw holes is not the ideal for which Processor Technology is striving. But Processor Technology, which is one of the leaders among microcomputer manufacturers, is offering a product that the Data General and Digital Equipment Corporation do not even have available.

Computer Power & Light of Studio City, California, is probably the current leader in microcomputer-based business systems. Gene Murrow tells me that Computer Power & Light is installing eight to ten business systems a month. Gene puts together his own hardware using a variety of boards and peripherals, then adds his own custom software. I hope Gene will call and tell me when he has installed his hundredth system.

There have been some interesting developments regarding new components. The AMD 9511 will be the arithmetic processor of choice for anyone whose microcomputer must perform a quantity of calculations. The AMD 9511 looks pretty much like any 8080A support device in terms of its hardware interface; it has logic to perform fixed and floating point arithmetic, together with a complete set of transcendental functions. Also it is very fast. Unfortunately, AMD is only starting to sample this part and it will not be available at a reasonable price until well into 1978. The National Semiconductor MM57109 is also an arithmetic processor, but really it is a calculator chip in disguise — and not a very fast one nor an easy one to use. You will probably want to wait for the AMD 9511.

16K Dynamic RAMs are available in quantity only from Mostek and NEC; Mostek is still the leader. A single 16K dynamic RAM costs $25.00 — when you buy them a thousand at a time. But once everyone else starts delivering, I predict the price will quickly fall to approximately $5.00. That should happen in about 18 months.

You saw it here for the first time: Zilog is coming out with a one-chip microcomputer to be called the Z8. The Z8 will have a subset of the Z80 instruction set; on the single chip you will have this CPU, 2K bytes of read-only memory, 128 bytes of read/write memory, two counter/timers, four I/O ports and one interrupt request line. The Z8 will probably be available sometime during the first quarter of 1978.

"There goes one of the last of the great 'HEX' programmers."

SENSE LINE

By Gary Coleman
President of the Midwest Affiliation of Computer Clubs

"Our membership is falling off!! What do we do?" This is a pretty common complaint among the older clubs. They've been around long enough to grow to a fair number then things start to falter. No one seems to know why, either, and the club seems to decline. Let's look at this phenomenon and see if we can correct it where it is already happening, or head it off before it does in other clubs.

First just what is it that makes you think your membership might be falling off? Could it be a false alarm brought on by the fact that your club is not growing as fast as it once did? Could this be a seasonal thing? Some of the MACC clubs have reported terrible attendance in the summer months for a number of reasons including the simple fact that it might be more fun to go swimming or play tennis than go to a computer club meeting. (Hard to imagine, isn't it?)

But suppose that it really is happening. Dues are not being renewed and meeting attendance is dropping. Let's look at the people who are still there. I guess there are a few basic types of members. The biggest percentage will belong to the two groups, the technicals and the non-technicals. The technicals are guys who have been in computers for years in most cases. Some are big system freaks and some are just good scroungers who seem to always be at the right place at the right time. The non-techs are new to the hobby and join the club looking for help. Now looking at your dying club, what kinds of members are hanging in there? Getting the older group back is now the problem.

It has been the plague of almost every club president to provide things of value and interest to both groups. We can get an idea of what must be done by analyzing the situation a little further.

The technicals join the club for different reasons than the non-techs. They have the most to offer the club and a fair amount of effort to keep them active will pay in many ways. They are also the group that might have the least to gain from the club, so it won't be easy to attract them.

The non-techs on the other hand have little to offer to the club. Most do not have a system yet and are a little bewildered by the whole thing. They want to learn and they want to get their own machine. Many of these will grow into the technicals, many will drop out and never be heard from again. They are, however, the largest group you are likely to have in your club and because of that they represent a resource. If nothing more they contribute dues!!

One of the tricks that has been very successful in many MACC clubs is to provide a club that can be viewed as a resource by all the members. To accomplish this it is very important to understand the needs of the members. In any problem involving people the solution will not always meet the needs of all groups. Maybe the needs of one group may be met by the resources of another group. Wouldn't it be neat if the needs of the second group could be met by the resources of the first group? This can be done in a number of ways.

Consider for a moment: **time.** (That's enough.) Put yourself in the shoes of the technicals. How do you view time? It's the thing that instantly goes away the minute you get your computer. The hours making cables are hours that have little value to you. Maybe you've become so good at scrounging that you have more projects than you can hope to accomplish in two or three lifetimes. What are you going to do? You need help!

Now put yourself in the shoes of the non-tech. You have no machine and offer no experience. You ache for the taste of hardware but have no idea where to begin or what to get. You waste a lot of time reading books that turn out to be useless and go to the meetings hoping to learn something or get in on some good deal. You need help!

It may not be immediately obvious, but the techs and the non-techs need each other. The techs have the expertise to design and teach and in most cases—prefer to spend their time doing that and playing with their computers. The non-techs have time on their hands that could be used for productive ends if they have the guidance. Now all of this seems to imply much involvement on the part of the techs, who might feel that they don't have the time. You must show that they can get back much more than they put into it.

One possible solution: Set up a bulletin board at your meeting. Divide it into two sections. Encourage the techs in the club to come up with projects for which they don't have time, but would like to see done. The non-techs can indicate that they have time on the other section. One member of the Cleveland Digital Group put a notice in their newsletter that he had two 9-track magtape drives and would gladly give one to anyone who could make one of them work. It was picked up by another member who had a lot of time on his hands and now has a 9-track magtape drive on his hands. One fellow wanted to get some wire-wrapping done for his computer interfaces so he fixed another member's machine in trade. The thankless job of building up a memory board can be traded for a soldering iron or a multi-meter. So the techs and the scroungers in the club start consciously collecting material explicitly for the purpose of trading hours of work. I got a backplane for a D-112 wired up (something I hate doing!) for the price of some help on a student's senior electrical engineering project. A million cases where this was the fruitful thing to do come to mind.

This new partnership between the techs and the non-techs has many useful side effects. First there are more people doing things, second the non-techs are learning things and being exposed to the talents and techniques of the techs. Third, the techs and scroungers will bring more equipment into the club by spreading their loot around.

It won't be easy to convince the technicals that getting a job done by someone else can do them good. It is possible to get burned in this kind of trade. But both sides run that risk, so just be careful. One thing that may help to convince the tech is pointing out that the non-techs have all sorts of resources and capabilities that the techs don't have.

I recently taught a course on digital logic for the club at my home. When one of my students hungrily eyed a flexowriter I had for years, I offered to sell it to him. His reponse was "Well, Gary, I don't have the thirty-five dollars right now, what will you take in trade?" I thought about it for a second and thinking that he didn't have anything I needed I jokingly said, "Yeah, a color television set." His response knocked me over. "No problem, I fix them for a living. Must have a dozen down at the shop. What kind do you want?" I have heard of people trading an automobile tune-up for all sorts of computer stuff. This is sort of interesting, isn't it?

In summary, people in your club have much to offer each other. It is the job of the officers of the club to make sure that the club members get the picture on this. When interaction between the members increases the reason for belonging to the club, the club will be that much stronger. A club will be based on the most solid bases known: A common good of all its members.

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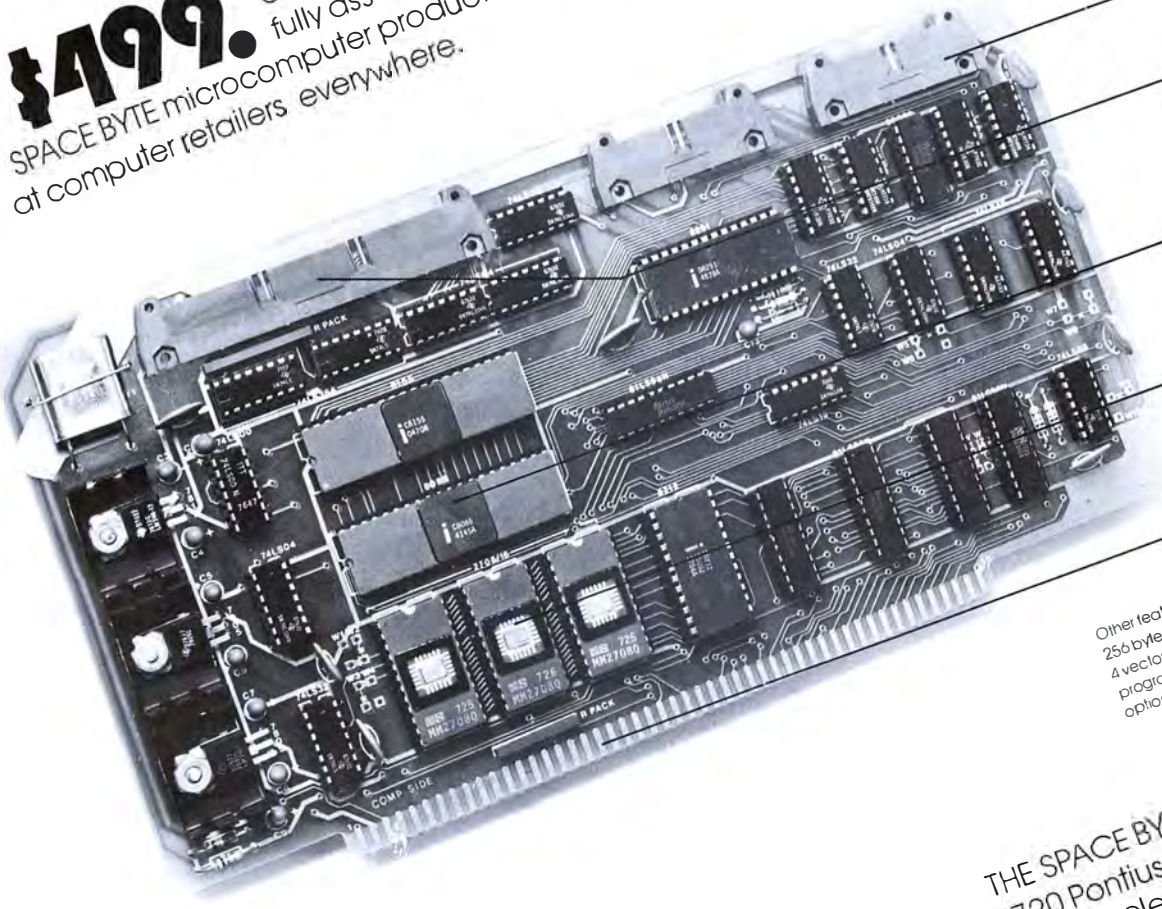

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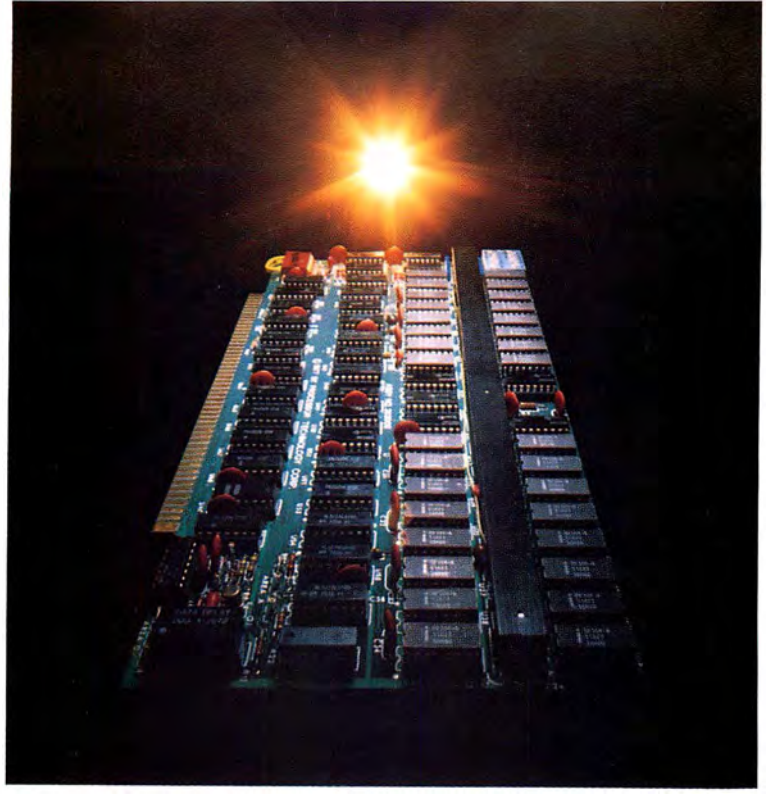

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ProcessorTechnology

Computerized Speeds Up

By Linda Folkard-Stengel,

Dactyloscopy means the art of reading fingerprints. Although it came into general use as a practical tool of identification less than a century ago, the knowledge is ancient. The cave painting of Altamira and Lascaux are "signed" by the artists pressing their handprints on the freshly-painted surfaces and numerous fingerprint impressions have been discovered on clay tablets used for writing by the Ancients and Babylonians. It is believed that most of these prints were not made accidentally since, in cuniform script on one tablet, now in the British Museum, we find the report by a Babylonian officer who was ordered to apprehend an individual and secure his fingerprints. Even the Apostle Paul who is reputed to have been literate, signed his epistles with his fingerprints.

Early in the 12th Century a Chinese author wrote a series of crime novels in which he alluded to the use of fingerprints in criminal identification. In one passage he describes how a man caught two women who had killed his brother and forced them to ink their fingers to record their fingerprints.

From these extant samples out of history we can perceive that the individual patterns of whorls and loops on everyone's fingertips were observed to be unique to the bearer and unchanging throughout the individual's life. Names can be changed, faked or misunderstood; physical features change with age or become altered by accident, and now features can be rearranged through surgery, but from before birth to beyond death the fingerprint patterns remain the same.

Practical and accurate methods of identification of the distinctive patterns were slow in developing. In 1823 Johannes Purkinje in his doctoral thesis described the fingerprint types and classified them into nine major groups. Dr. Purkinje's work was advanced by Sir Francis Galton who divided print patterns into three groups, arches, loops and whorls. These three classifications remain the basis for the modern techniques.

In the last decade of the 19th Century, the theory of dactylography was well established, but as yet it was a science in search of an application. In 1891 Juan Vucetich, an Argentinian police official was the first to recognize fingerprinting as an important tool in forensic investigation. He established the first criminal fingerprint files.

In England Galton's system combined with a method of identification based on physical measurements developed by Alphonse Bertillon, was established in 1894 and eight years later M. Bertillon became the first to identify an unknown criminal suspect solely by fingerprints.

This breakthrough fired the public imagination, stoked by the rich fuel of Sir Arthur Conan Doyle's prolific fictional output in his Sherlock Holmes series.

In the United States the first use of fingerprints was for non-criminal registration and is believed to have occurred in 1902 when the head of New York City's Municipal Service Commission required that all civil service applicants be fingerprinted. A year later dactyloscopy was officially adopted for identification purposes in the New York Department of Prisons and a fingerprint bureau was installed at Leavenworth Penitentiary the following year. Between 1905 and 1908 the armed services adopted the system and the Federal Bureau of Investigation began using the technique in 1908.

An Act of Congress in 1924 officially established an identification bureau within the FBI. Subsequently the print records from Leavenworth and from the International Association of Chiefs of Police were combined

Dactyloscopy Fingerprint Search

Feature Editor

and added to the FBI file. Since that time the FBI has served as the national clearinghouse and repository. Criminal files alone now contain more than 72 million fingerprint cards representing in excess of 21 million persons. In addition the FBI maintains a separate bank for non-criminal identification such as government employees, all military personnel, security-cleared personnel and aliens.

Some 22,000 fingerprints are received at the FBI bank each day and about 15,000 of these must be searched against existing fingerprint files. To handle this huge matching task, approximately 3,000 persons are employed, half of whom are trained dactyloscopists.

The task involves a number of steps, reading, classifying and matching. Until recently all this was done by eye alone. In examining a print, the technician picks out various characteristics to determine the pattern type such as arches, tented arches, ulnar loops, radial loop and whorls. After the general pattern is determined, the classification is broken down to finer points and progressively smaller groups of characteristics. The process enables the narrowing of classification from millions to a few thousands.

This painstaking work was ripe for assistance from computer technology. In 1962-63 the FBI initiated a joint study with the National Bureau of Standards regarding the feasibility of automating the FBI's dactyloscopy banks. The contract was awarded to Rockwell International who had been engaged in basic research in electronic pattern recognition systems. In response Rockwell developed its PRINTRAK™ product line consisting of card readers, image scanners and processors, search computers, printers and storage facilities. The systems can operate on stand-alone mode or can be coupled to central processing files by means of telephone lines. (See Figure 1 and Photos 1 and 2.)

The PRINTRAK™ method operates on the recognition of the detailed features on each print, called the minutiae bifurcation — forks in the lines and ridge endings (See Figure 4).

For information storage a print is placed in a high-speed card reader. A scanner "reads" the print taking less than one second per item, enhances the image to provide better contrast between light and dark areas, edits out the unreadable parts, determines the direction of the ridge flow and locates the minutiae of the fingerprint. (See Figures 2a, 2b, 2c, 2d and 4.) The information is sent to the control computer which performs a final editing before sending the binary-encoded data to a DEC PDP 11/34 minicomputer, the data output processor, which classifies the fingerprint for storage.

Retrieval of data can be achieved by alphanumerics or by electronic dactyloscopy.

Most of the PRINTRAK systems are large and complex, however one model reads a fingerprint image directly from the individual's finger and compares the input with its limited file. This installation is principally used for security systems. (See Photo 3.)

For criminal identification the local installation couples with the central data bank. Even a partial print lifted at the scene of a crime can be used for automatic search for a match. The *latent* image is placed on the scanner, the existing features are enhanced and displayed on the CRT. A technician using a cursor annotates the outstanding features in the latent print. Then the operator initiates an automatic search to match the latent against those prints on file. The search can be general in nature to cover all the filed prints or more specific as

PHOTO 1. CRIME SOLVER — Printrak 250L, automatic Latent Fingerprint Identification System designed to make it feasible for the first time for police to match fingerprints left at crime scenes (latents) against those already on file, is checked by engineer Ray Mendoza. Built by Rockwell International's Autonetics Group, the system can match latents of varying quality against file prints at up to 250 fingers per second.

PHOTO 2. CLOSE LOOK—Enhanced view of fingerprint.

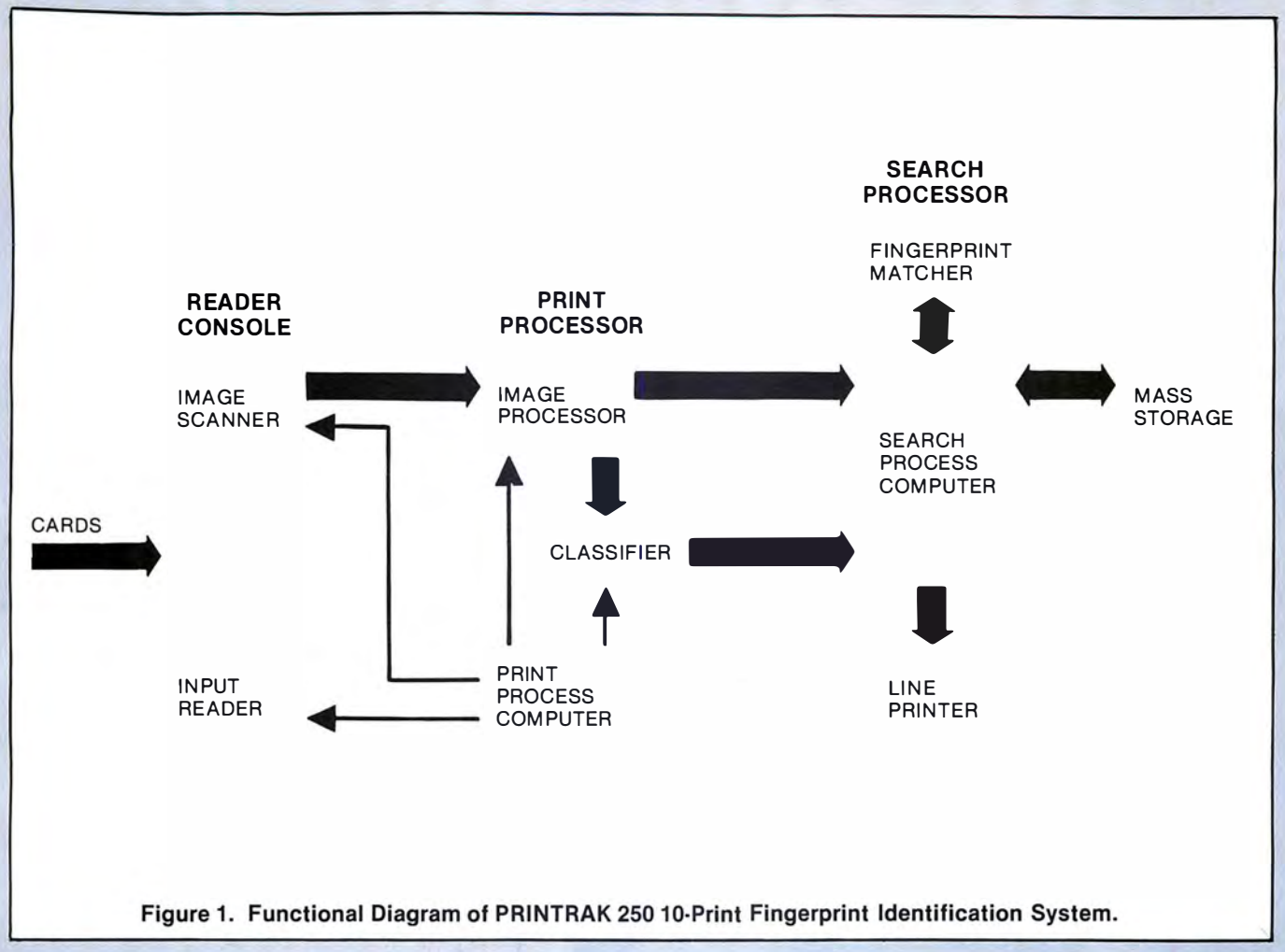

Figure 1. Functional Diagram of PRINTRAK 250 10-Print Fingerprint Identification System.

Figure 2a. Original Print

Figure 2b. Enhanced Print

PHOTO 3. DIRECT READER — Printrak 250 Direct Reader system developed by Rockwell International's Autonetics Group verifies the identification of a person based on a fingerprint image read directly from the individual's finger. The system has applications in areas including access control; credit card verification, 24-hour banking and other financial transactions; immigration control, and numerous other uses where positive identification of a fingerprint is required to identify a person.

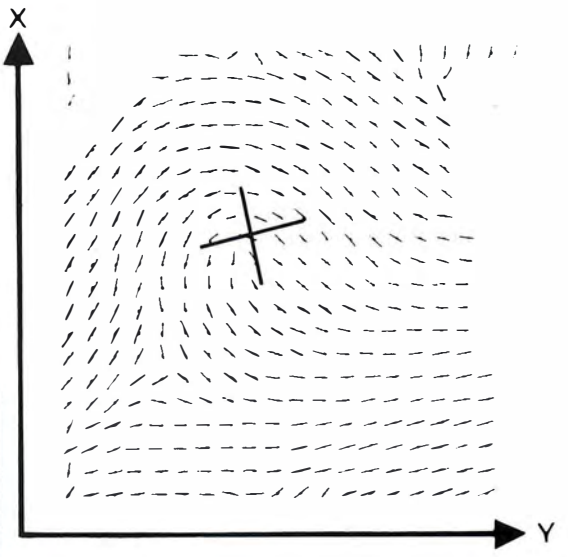

Figure 2c. Ridge Direction Plot

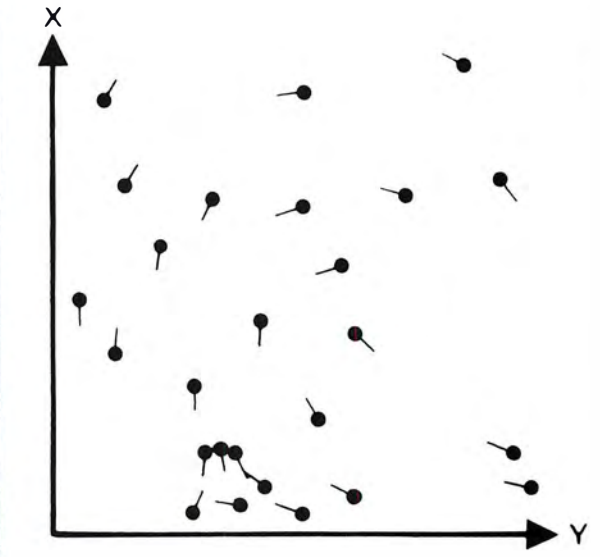

Figure 2d. Minutiae Plot

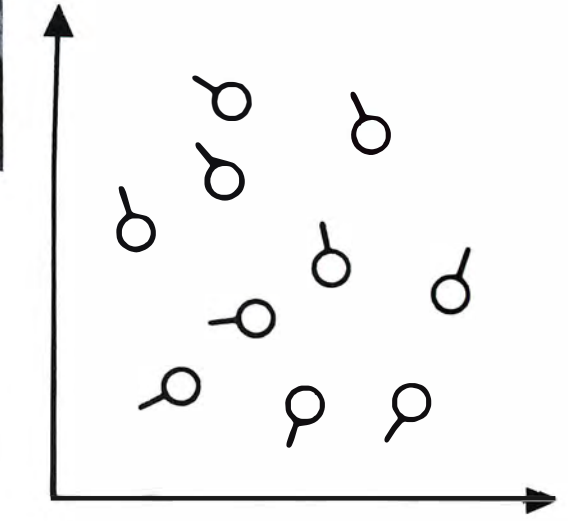

Figure 3a. Unknown Print

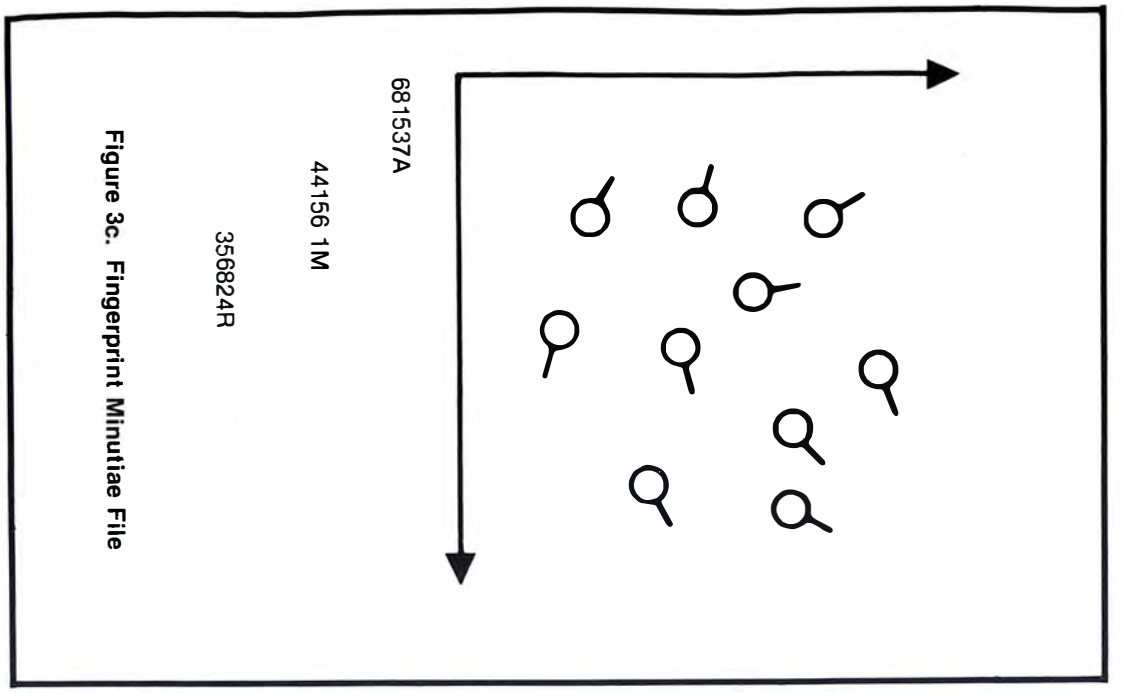

Figure 3c. Fingerprint Minutiae File

356824R

44156 1M

681537A

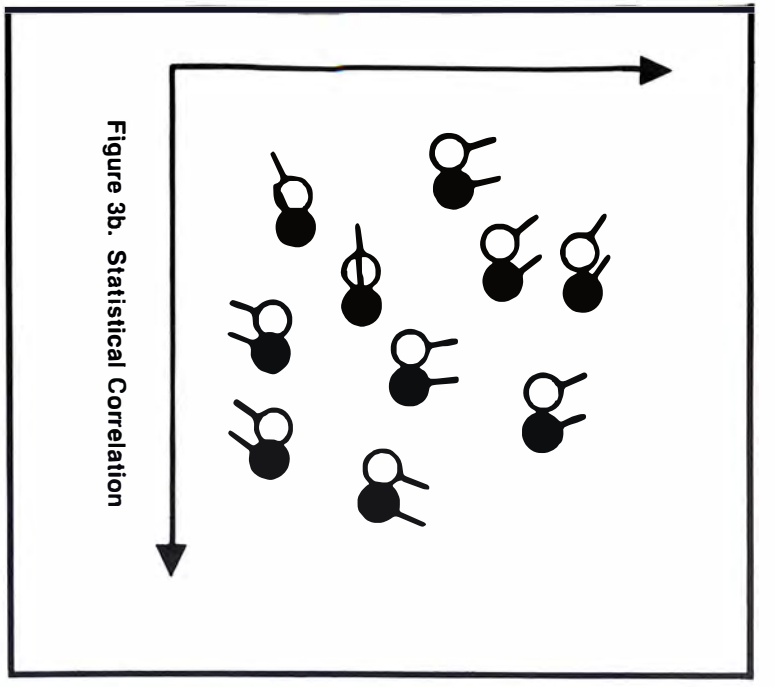

Figure 3b. Statistical Correlation

determined by descriptive information entered by the operator such as the suspect's approximate age, type of crime, which finger of the ten, if known, and what class of fingerprint pattern (Figures 3a, 3b, 3c). At the end of the search the system delivers a printout of the potential suspects, all numerically ranked by probability of match. Final verification of the actual match is made by the operator who has now narrowed his field down to a limited number of cards instead of the potential thousands or hundreds of thousands.

By this method criminal identification can be sped up and arrest probabilities enhanced because of the time saved.

Electronic dactyloscopy has many functions in civilian identification. Amnesia victims can be identified, naturalized citizens can call upon the service for social security purposes and charge card holders can have protection against theft.

Other potential uses of this system cannot properly be called dactyloscopy, rather pedoscopy or rhinoscopy. Pedoscopy, footprinting, is already in use in some hospitals for identification of newborns. Rhinoscopy, noseprinting, is used by the Department of Agriculture of the Government of Canada for registration of pedigreed livestock. Features similar to fingerprints are found on the nose ridges of most mammals. These records remain on file for the natural life of the animal unless advised by the owner of the animal's demise. This meritorious system has not yet been introduced into the United States animal recording agencies, but with the increased incidences of petnapping and rustling, the feasibility of introducing such methods should be considered, especially since technological means are now readily available.

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Fingerprint Handbook, by Annita T. Field, Charles C. Thomas, Springfield, IL 1959.

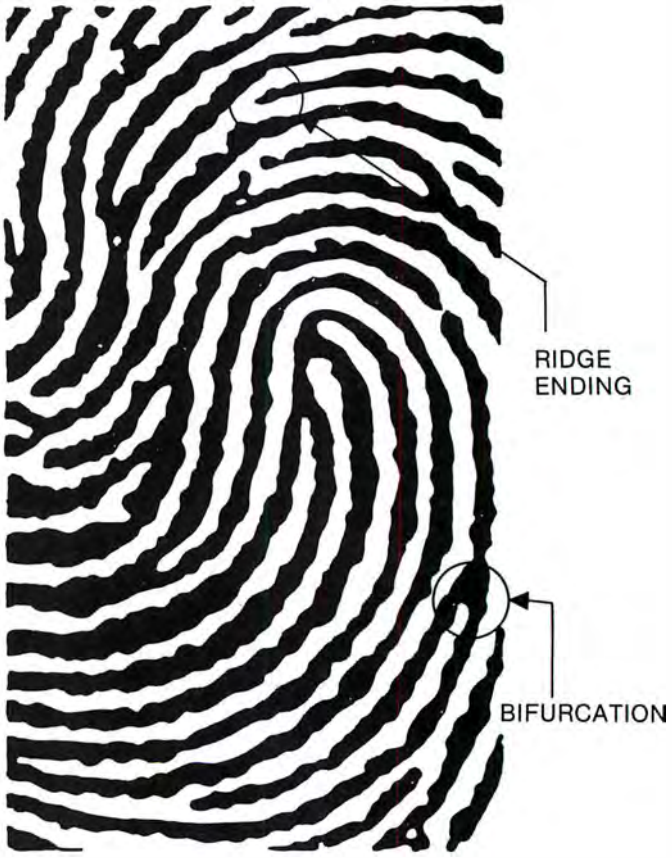

Figure 4. Minutiae

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It's finally happened! The Axiom EX-800 provides full performance hardcopy at a price compatible with today's low cost micros. This little 80-column machine zips along at 160 characters per second (14 times faster than a teletype) — at a breakthrough single quantity price of $655 for a complete printer.

When we say complete we mean it

The EX-800 is a stand-alone unit with case, power supply, 96 character ASCII generator and interface, paper roll holder, infra-red low paper detector, bell, and multi-line asynchronous input buffer. You won't find these standard features on any other printer, regardless of price!

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Our printer is so complete, that we offer only one option. A serial interface (RS 232C or current loop) good for 16 baud rates from 50 to 19,200 and thoughtfully provided with a switch for either Centronics or Tally compatibility. Might we call it a Tally-whacker? At $85.00 it certainly should be!

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The advantages of electrosensitive printing

The EX-800 can print 80, 40, or 20 characters across the five inch wide electrosensitive paper. Under software control, single characters or words may be printed larger for emphasis. The permanence of the hardcopy is archival, because once the aluminum coating has been removed, there is no way to put it back. It's unaffected by sunlight, moisture or heat. Although the printer doesn't provide multiple copies, excellent quality photocopies can be made from the high contrast printout. Also, the paper is inexpensive and readily available, costing about 1¢ for an 8½ x 11" equivalent.

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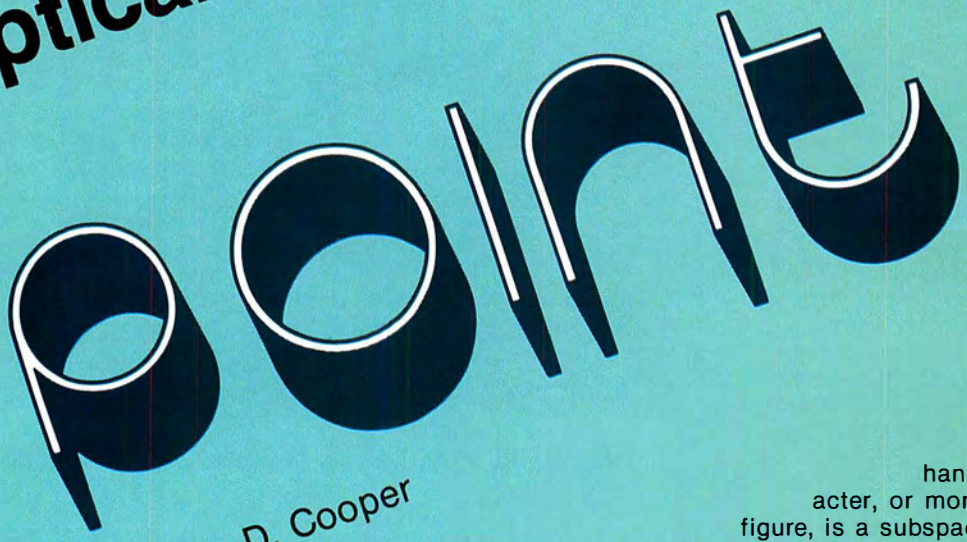

by Ellis D. Cooper

INTRODUCTION

The function of an optical character-recognition device is to output a unique "electrical pattern" corresponding to each printed (or handwritten) figure which is presented to its input sensor. The same output should appear for every occurrence of the "same" figure. The function of an optical character-classification device is to divide a sufficiently large set of printed figures into classes of "recognizably similar" figures. An adaptive optical character-recognition device would combine the functions of both classification and recognition. Here the emphasis is on recognition rather than on classification, but "point-humans" did come about in consideration of the problems of developing a software structure for adaptive optical character-recognition, i.e. to recognize the "6-ness" in a 6 or the "b-ness" of a b. These problems include font-flexibility, mis-registration, broken lines, holes, rigid sets of rules for handwriting (a training program for personnel), etc.[1]

A printed or handwritten character, or more generally a figure, is a subspace of the surface upon which it appears. The simple thought-experiment which could lead to a theory of *point-humans* is to imagine being very tiny and inside of such a "letter-space." In the limit, you become a *point-human*. A *point-human* is an abstraction of the attributes and powers of a human being which are relevant solely to the classification and recognition of letter-spaces "from the inside."[2] Thus, gravity is irrelevant to a *point-human*. All senses but vision are irrelevant, and since a *point-human* can have but one eye, it is a monocular being. At any given time a *point-human* has a position — its "viewpoint" — and a "view," namely the "visible" part of the boundary of the ambient letter-space. The locomotory powers of a *point-human* are confined to translation within the ambient letter-space; we say it has "jets." The cognitive powers of a *point-human* include a perfect memory, flawless deductive powers (in standard logic), and an unerring sense of direction. The single-minded purpose-in-life of a *point-human* is to apply its perceptual, locomotory, and cognitive powers to the classification and recognition of letter-spaces.

DETERMINATION OF AMBIENT LETTER-SPACE

Every printed letter or character or figure corresponds to a more or less well-defined subspace of the surface upon which it is printed. For the sake of discussion,

and Computers: humans

let us assume that the subspaces corresponding to letters are perfectly well-defined — no broken lines, no holes, etc. — and that they are subspaces of a plane surface.

The subspaces corresponding to printed letters are called "letter-spaces," although the latter term shall also include any subspace of a plane satisfying certain conditions which delimit an abstract concept of the printed figure. But, before giving a more formal definition of letter-space, it is first necessary to introduce a little terminology from the mathematics of curves in a plane. A continuous curve in a plane is "piecewise smooth" if at every point but for a finite number of exceptions called "corners" there is a well defined tangent-line (See Figure 1). A curve is "simple" if it never crosses itself, and is "closed" if it has no ends. Let us call a piecewise-smooth, simple, closed curve a "boundary curve." A boundary curve sub-divides the plane three mutually non-overlapping subspaces of the e, namely the bounded interior region, the bound urve itself, and the unbounded exterior region. I nd B are boundary urves and A is entirely contai n the bounded interior region of B, then we say B "enclosed" A, or that A is "enclosed by" B.

A "letter-space" is a boundary curve C plus its interior region, minus the interior regions of a finite number (possibly zero) of mutually non-overlapping, non-enclosing boundary curves all enclosed by C. The sum of all these bo dary curves is calle he "boundary" of the letter-spa .

Assum a *point-human* is dro ped into a letter-space at random. Its problem is to an wer as quickly as possible the question, "What letter-space am I in?". Answering this question is called "determination of the ambient letter-space." One might think that all the *point-hu* would have to do is explore the entire boundar d compare what it s to the elements of a master c log of letter-space ies, and that th the determination of the ambient letter-space would follow. This is true, except that it may very well be unnecessary for the *point-human* to see the entire boundary. This is very important for it has a direct bearing on how much time, on the average, that it should take before the determination is achieved.

THREE FACTS

A point in a letter-space is called a "viewpoint." A viewpoint is said to be "visible" from another viewpoint if the line segment connecting the two is entirely contained in the ambient letter-space. The "view" at a viewpoint is the set of all boundary points which are visible from the viewpoint. At any given time during its exploration of a letter-space, a *point-human* has a view. The First Fact of a *theory of point-humans* would be that only a finite number of views is necessary for the determination of a letter-space. Hence a *point-human* dropped at random into a letter-space would have a view, and would need to make only a finite number of "jumps" before announcing

"The mine is always bigger than the gem."

How shall a *point-human* make the most of the information available to it in a single view? The Second Fact of a *theory of point-humans* would be that the only relevant information in a view is contained in a finite list of features — a "feature-sequence" — obtained by scanning (say, clockwise) once around the view. The possible features are summarized with examples and symbols in Table I, and an example of a feature-sequence is given in Figure 2.

Any directic ich there is an abrupt increase or decrease of distance (versus angle o irection) has very special significance to a *point-human*. It means that a portion of the boundary is occluded by some other portion of the boundary, i.e., there is a "mystery" (Figure 3). The Third Fact of a *theory of point-humans* would be that "mysteries must be looked into." The aforementioned Three Facts of a *theory of mans* imply that a finite li ture-sequence le for making the determ of a letter-spac e generated

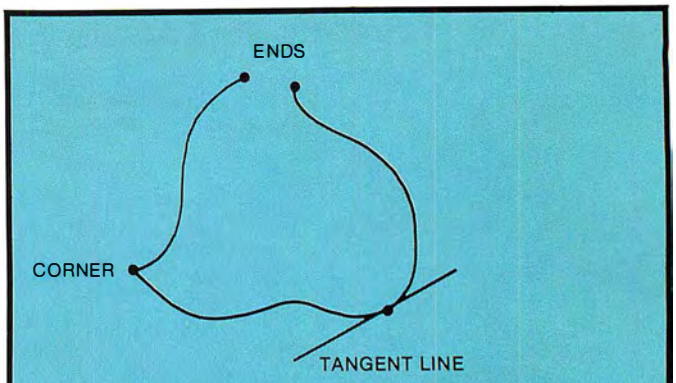

Figure 1a. Piecewise-smooth curve.

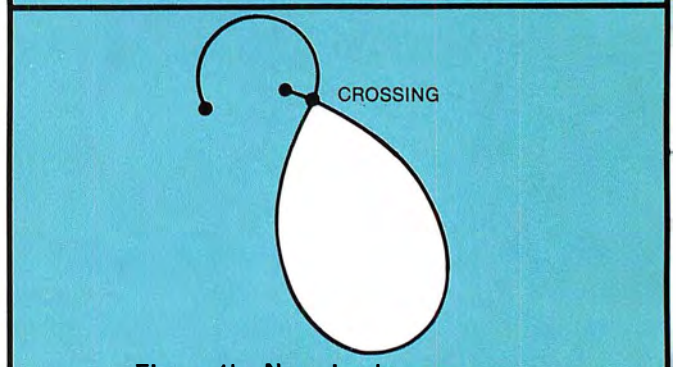

Figure 1b. Non-simple curve.

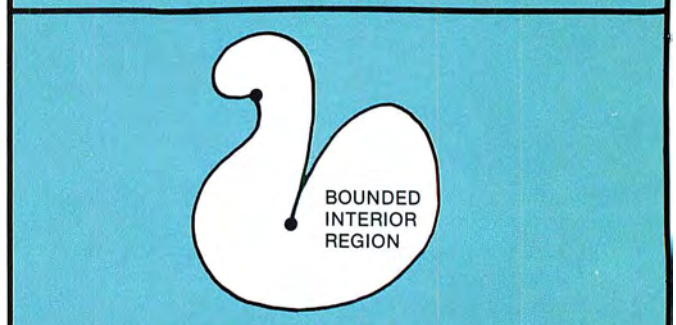

Figure 1c. Boundary curve.

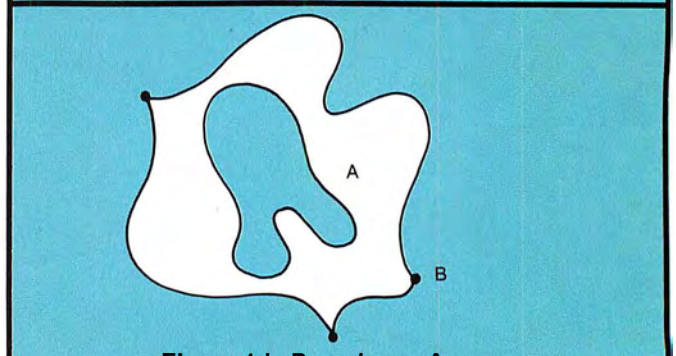

Figure 1d. B encloses A.

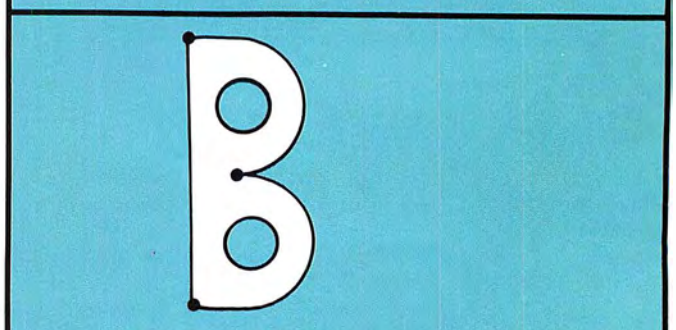

Figure 1e. A 'B'-space.

by an algorithm which includes a mystery-reduction directive: jump wherever necessary to diminish mysteries.

To make its determination as quickly as possible, a *point-human* should have the "intellectual capacity" to unite feature-sequences of views and make a "guess" about the ambient letter-space, even if the entire boundary has not yet been seen. The mathematics of uniting feature-sequences would be contained in the theory of "global constructions," which has been given an elegant, detailed, abstract formulation.[3] Thus, a *theory of point-humans* would be an occasion for applying category theory to string-manipulating, pattern-recognition algorithms.[4]

A META-STRATEGY

A mathematical *theory of point-humans* would possibly lead to synthesis of efficient strategies for software simulation of *point-humans* actively seeking to fulfill themselves. At the very least, the apparatus of such a theory should be a valuable tool for the analysis and validation of strategies derived in any way.

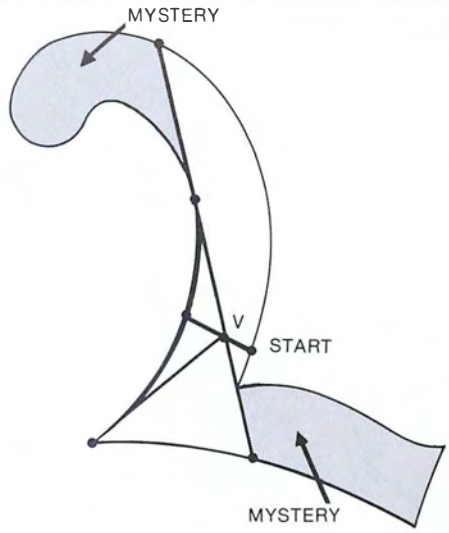

Figure 2. The feature-sequence at V in this 'L'-space is

(1)(C)(C

TABLE I

POSSIBLE FEATURES OF A VIEW

DISTANCE VERSUS ANGLE (Clockwise Scan)	EXAMPLE	SYMBOL
LINEAR DECREASE		
CONVEX DECREASE		
CONCAVE DECREASE		
LINEAR INCREASE		
CONVEX INCREASE		
CONCAVE INCREASE		
JUMP DOWNWARD		
JUMP UPWARD		

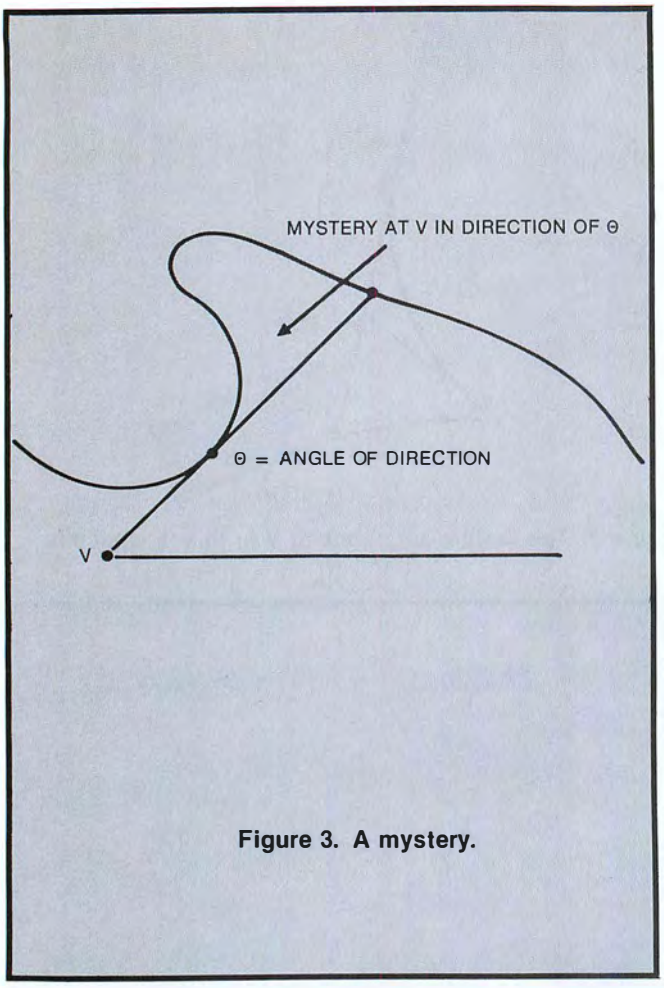

Figure 3. A mystery.

For example, one way to develop strategies for adaptive optical character-recognition would be to give human beings an opportunity to make believe that they are *point-humans* (see Figure 4). A microcomputer videographics system of sufficiently great memory and resolution could provide a visual display of a view in a letter-space. The viewpoint of the view could be under manual and pedal control of the human being, whose job or game it would be to deduce from consecutive displays what letter-space the microcomputer has previously chosen, probably by a "random" process. The "game" is to recognize the letter-space within a pre-defined time limit. This is a simple "solitaire" example of a whole new family of games called "*point-human* video-games." Such games can have much in common *with* familiar games, such as guessing games, pocket billiards, chess, lunar-lander, etc. Elaborate examples could involve contests between (1) two humans with software ray-guns, constructible and destructible barriers, scoring penalties for bad jumps or guesses, etc., or (2) a human and a software-simulated *point-human*, or (3) two software *point-humans*.

Consider a hypothetical *point-human* video-game tournament. The winner would most probably be a human being with special strategies. Being human, he or she would want to explain how it was done, and would then be awarded a prize, including a citation as *"Point-Human of the Year."* Thus, there is a strategy for finding strategies, i.e., there is a meta-strategy for adaptive optical character-recognition.

THEORY OF VISION

A key problem confronting any cognitive-psychological theory of vision is to explain "integration of local views into global wholes." The mathematics of global constructions, as in a *theory of point-humans,* might offer some help. In any case, the formal apparatus of such a theory, plus the software and hardware of a *point-human* video-game system, could provide a flexible testing-ground for hypotheses about visual integration.[5] Other problems in the theory of vision, such as depth perception, might also be looked into from the *point-human* viewpoint.[6]

CINEMATOGRAPHY

Allan Redfield has suggested a possible application of the formal apparatus of a *theory of point-humans* to cinematography. He says that film-makers would be very happy to be able to create real-time "video-storyboards" on a video monitor. That is, a director, say, should like to be able to sketch a figure or figures moving against a sketch of a background. If this "sketching" of motions and views could be accomplished on location, say by typing at a keyboard, then much time and money could be saved. The relevance of *point-human* theory is that the natural 2-dimensional generalization of a feature-sequence, that is, a "feature-array," would be an algebraic representation of a scene.

There is even a possibility to provide the film-maker with a "3-dimensional" video storyboard. The idea is that he or she would wear a radiant-energy headband. The microcomputer, via suitable energy pickups, would triangulate to find the head's position, and compute a feature-array transformation leading to display of the view from the current head-position.

ELECTRONIC MUSIC

The problems of devising a general notation for electronic music may never be solved. But the idea of *point-*

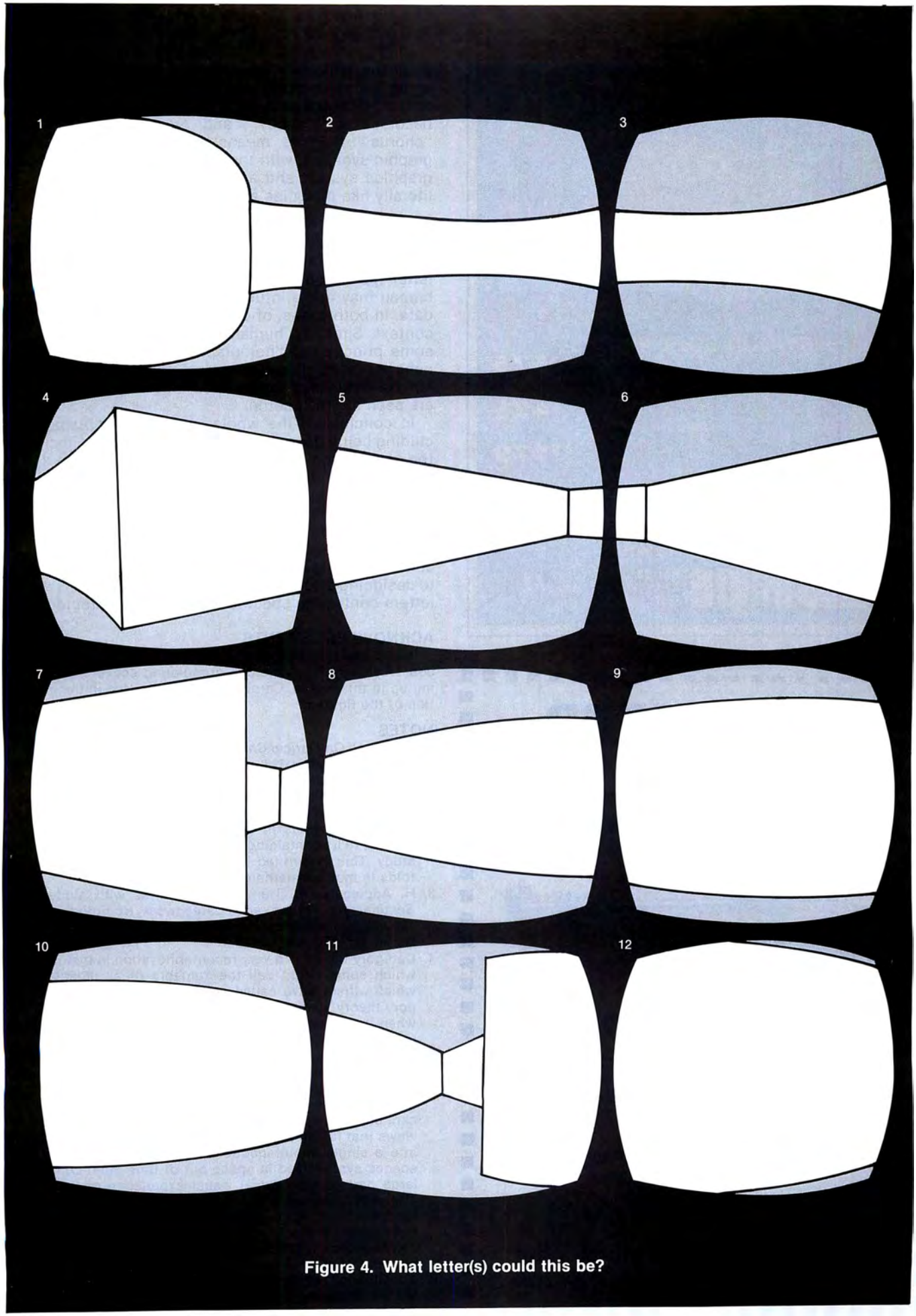

Figure 4. What letter(s) could this be?

humans suggests a notation which would "speak for itself." The view from a viewpoint in a letter-space corresponds to a function of distance versus angle. Suppose the units of measurement are changed, so that angle becomes time, and distance becomes pitch, or any other electronic music parameter, then the view becomes a "melody," and simultaneous views, a "chorus." By this means a composer may design graphic symbols, with the help of a *point-human* videographics system and a synthesizer, which are shaped literally like melodies and rhythms.

ARTIFICIAL INTELLIGENCE AND BEYOND

Joe Truchsess points out that there is an analogy, between how a *point-human* may guess the ambient letter-space from an incomplete set of views, and how a human may make intuitive leaps based on incomplete data. In both cases, of course, a large role is played by context. Similarly, human memory, far from relying on some principle of "holographic redundancy," may depend more on global constructions from partial data. Maybe "concepts" are unified only after certain views are seen to "fit together."

In conclusion, the whole idea of *point-humans*, including being deposited at random in a space, including the compulsion to classify and to recognize the space, and including the accumulation of local data until suddenly there is enough information to venture a guess on the global situation, may be seen as somehow analogous to the entire human scientific endeavor. With the understanding of how the human mind uses partial data to construct an essential system, we become one step closer to designing a computer which can read a partial letter or letters containing specific handwriting characteristics.

ACKNOWLEDGEMENTS

It is a pleasure to thank Gerald Volpe, Allan Redfield, and Joe Truchsess for numerous stimulating conversations leading up to this article. Carolyn Buckley assisted in the preparation of the figures.

NOTES

1. *Auerbach On Optical Character Recognition,* Auerbach Publishers, Princeton, NJ, pp. 18-21, 34-35.
2. This is somewhat reminiscent of Gauss' simplifying idea of studying the "intrinsic geometry" of a surface by considering only those properties of the surface which could be observed by "beings in the surface." The relationship of a surface to its containing space was thereby made a separate study. This in turn led to the global construction of manifolds in modern mathematics.
3. H. Applegate, M. Tierney, "Categories with Models," in *Seminar on Triples and Categorical Homology Theory,* 1969, Lecture Notes in Mathematics 80, Springer-Verlag Berlin, pp. 156-244.
4. Category theory is a very recent innovation in mathematics which some might call the "algebra of all algebra," and which others have called "abstract nonsense." But category theory, like much in mathematics, is "nonsense" only when it is engaged merely in toying with itself, rather than in application to outstanding problems.
5. "In 1965, Parks reported an immensely interesting phenomenon: if a pattern is moved behind a stationary slit so that its parts appear successively in the same place, the entire pattern can be recognized . . . the visual perceptual system can, under the proper conditions, assemble a set of partial views that fall on the same retinal area over a period of time into a single simultaneous form or scene; and . . . such scenes synthesized in space out of time must comprise a large part of the normal visual experience on which our attempts at perceptual laws are based." I thank Allen Redfield for bringing to my attention this quotation from J. Hochberg, "In the Mind's Eye," in *Contemporary Theories and Research in Visual Perception,* ed. R. Haber, Holt, Rinehart and Winston, 1968, p. 314.
6. J.J. Gibson, *The Perception of the Visual World,* Houghton Mifflin Company, Boston, 1950.

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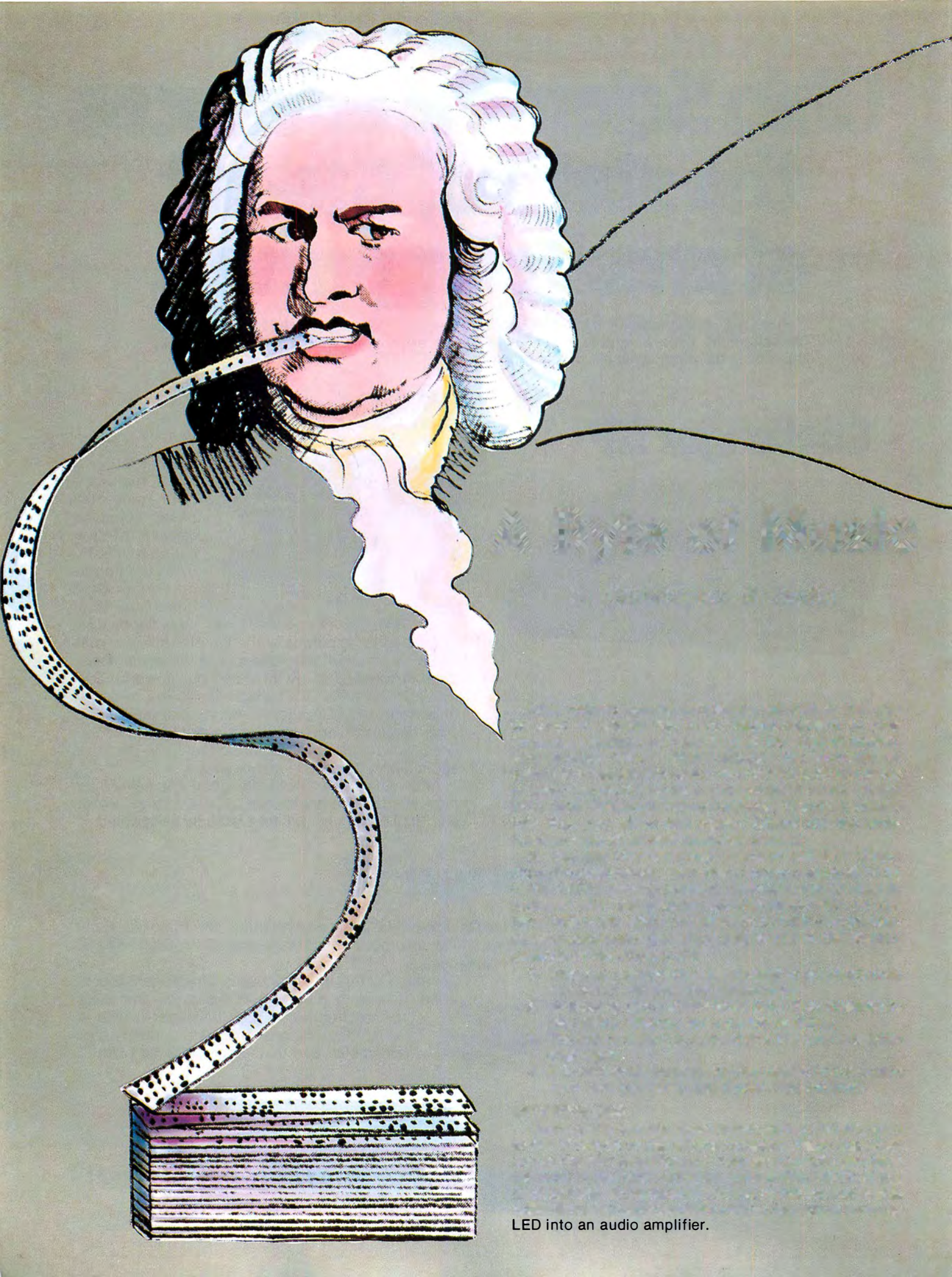
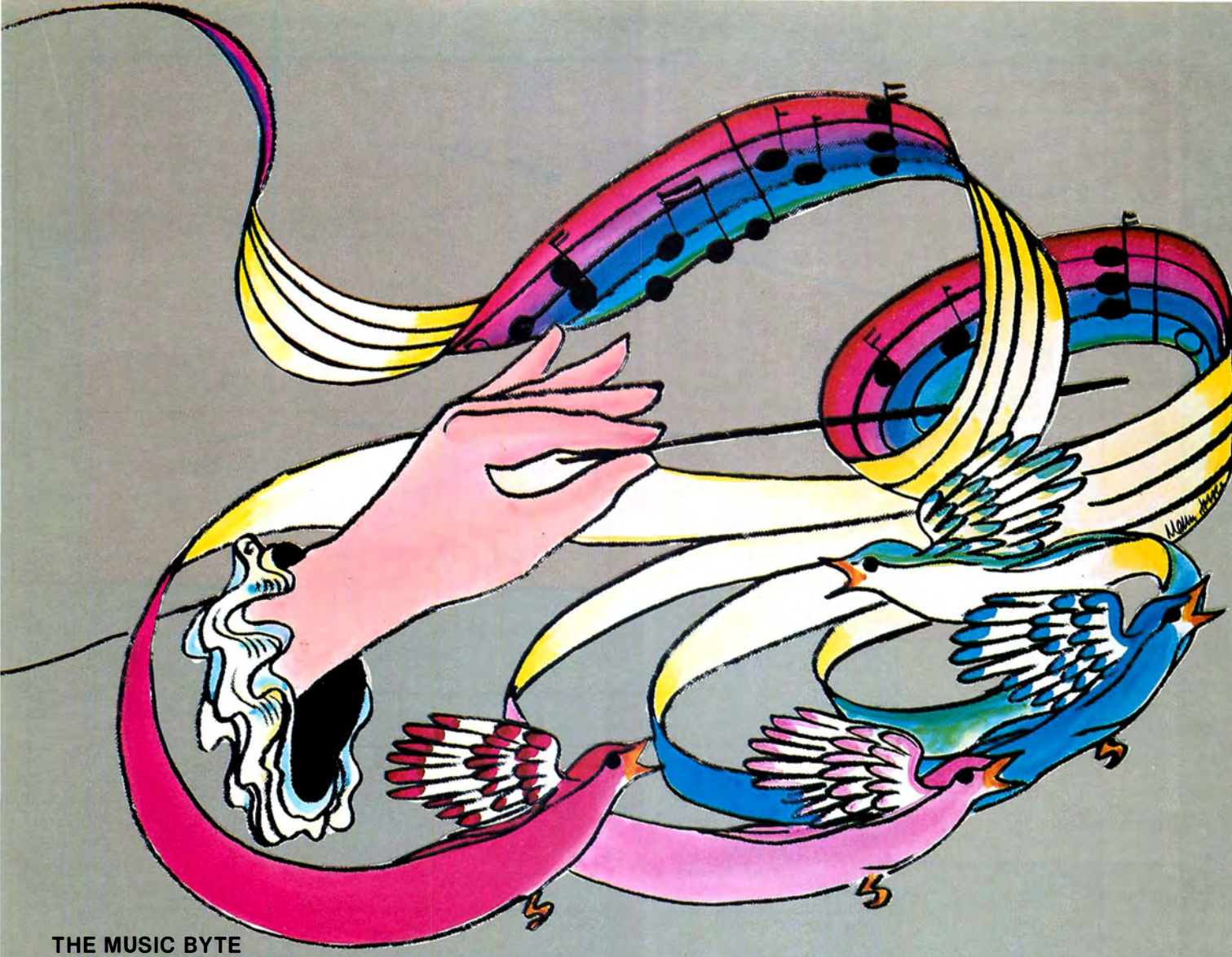


LED into an audio amplifier.



THE MUSIC BYTE

One of my prime objections to the way I had seen most "music programs" operate was their use of two bytes of program memory to deliver one byte of music. The first byte in most systems I have seen indicates the note, and the second byte provides the duration information. My second objection was that conversion from written music into a useable code was always left as a mystery, and one soon discovered that nice logical changes in note frequency did not sound in the least bit musical.

In order to get both note and duration information into a byte that the micro could swallow, I had to invent the "Music Byte." (See Figure 2.) The first three bits of the byte are the "note bits;" the next three bits are the "duration bits;" and the final two bits indicate the octave. As the note to be played is indicated by three bits, any one of eight different notes can be indicated. In actuality we only need seven of these possibilities because the eighth note of the scale is exactly double the frequency of the first. To indicate the eighth note of the first octave we merely tell the micro that it is the first note of the second octave (which it is). Bits 3, 4 and 5 indicate the duration of the note. Music is generally written as whole notes, half notes, quarter notes, etc. This information can readily be put into the three bits allocated for duration. There are two bits left to convey octave information. Both bits zero indicate the first octave; bit 6 set indicates the second octave. To date only the first and second octaves are used but this has proven adequate for most of the music that has been transcribed. It is a simple task to insert additional octaves into the flow chart at the location marked by an asterisk.

The music byte, then, merely indicates which note of which octave is to be played and indicates for how long it is to be played. This makes it quite easy to convert that hard-to-figure-out diatonic scale into the simple and logical binary equivalent.

HOW IT WORKS

The 1802 microprocessor contains 16 user-definable 16-bit registers. These registers are used by the program as counters, pointers, and for storage of constants. Constants corresponding to notes are required because, for ease in coding, the music byte does not indicate the frequency to be produced, but merely the number of the note (1 through 7). One of the registers is employed as the frequency synthesis counter. This counter is loaded with the constant of the note to be played and decremented until it reaches zero. When the counter reaches zero, an output of the microprocessor is set or reset. It is this change of voltage that is coupled across the interface and amplified at the radio. If this output is changed at an audio rate, a note is heard. One of the registers is used as a duration counter. This counter is decremented until it reaches zero at which time the frequency synthesis counter stops generating the note and the next music byte is fetched from memory. One of the registers is used to point to the next music byte, and one is used as the program counter. If a music byte is zero, the end of the tune is indicated and the stack pointer is reset to the beginning of the song. If the music byte is non-zero but the note bits are all zero, the CPU marks time with no ops until the duration counter

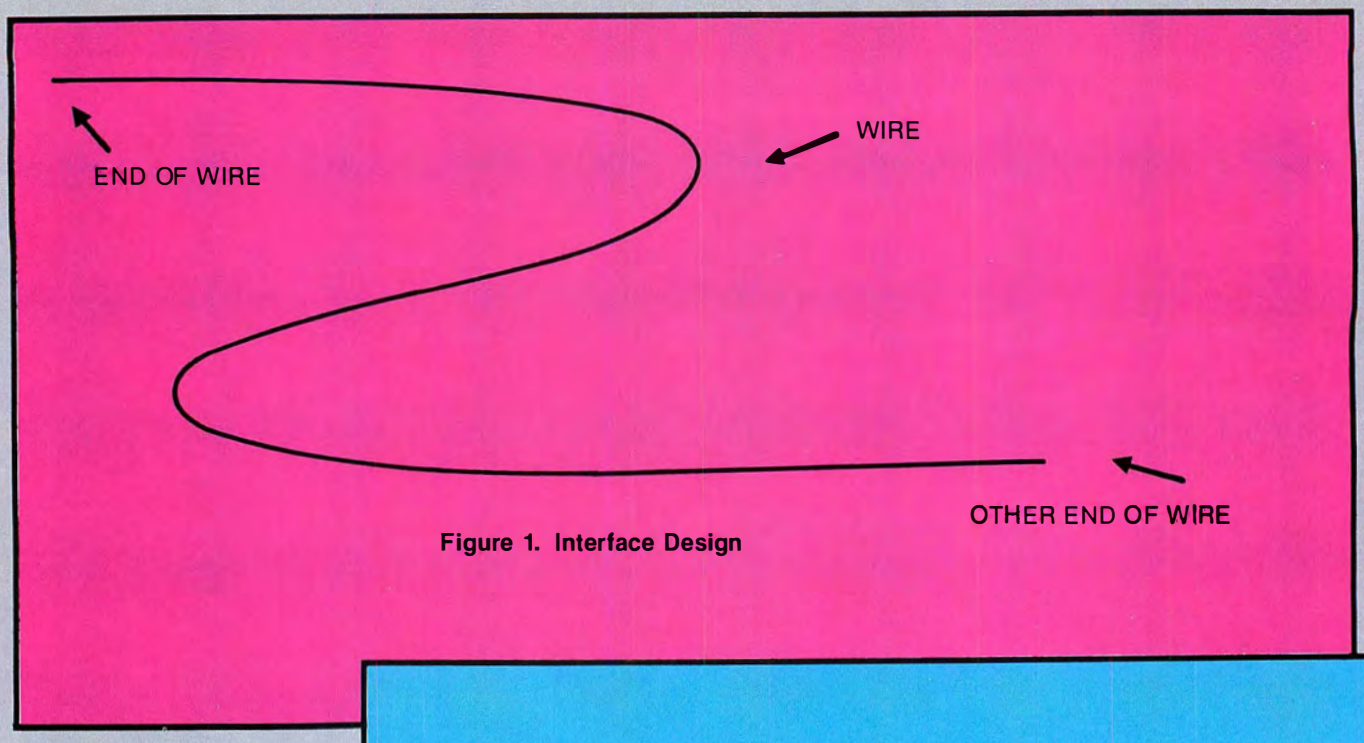


Figure 1. Interface Design

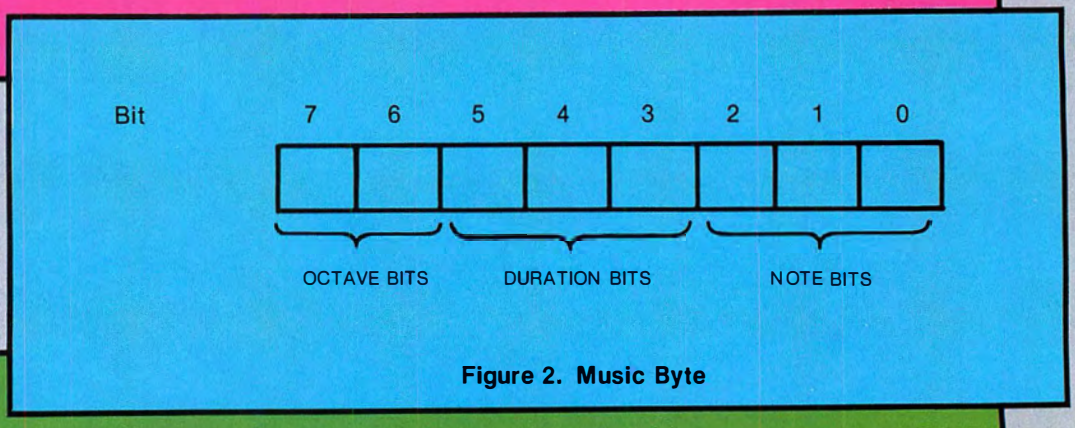


Figure 2. Music Byte

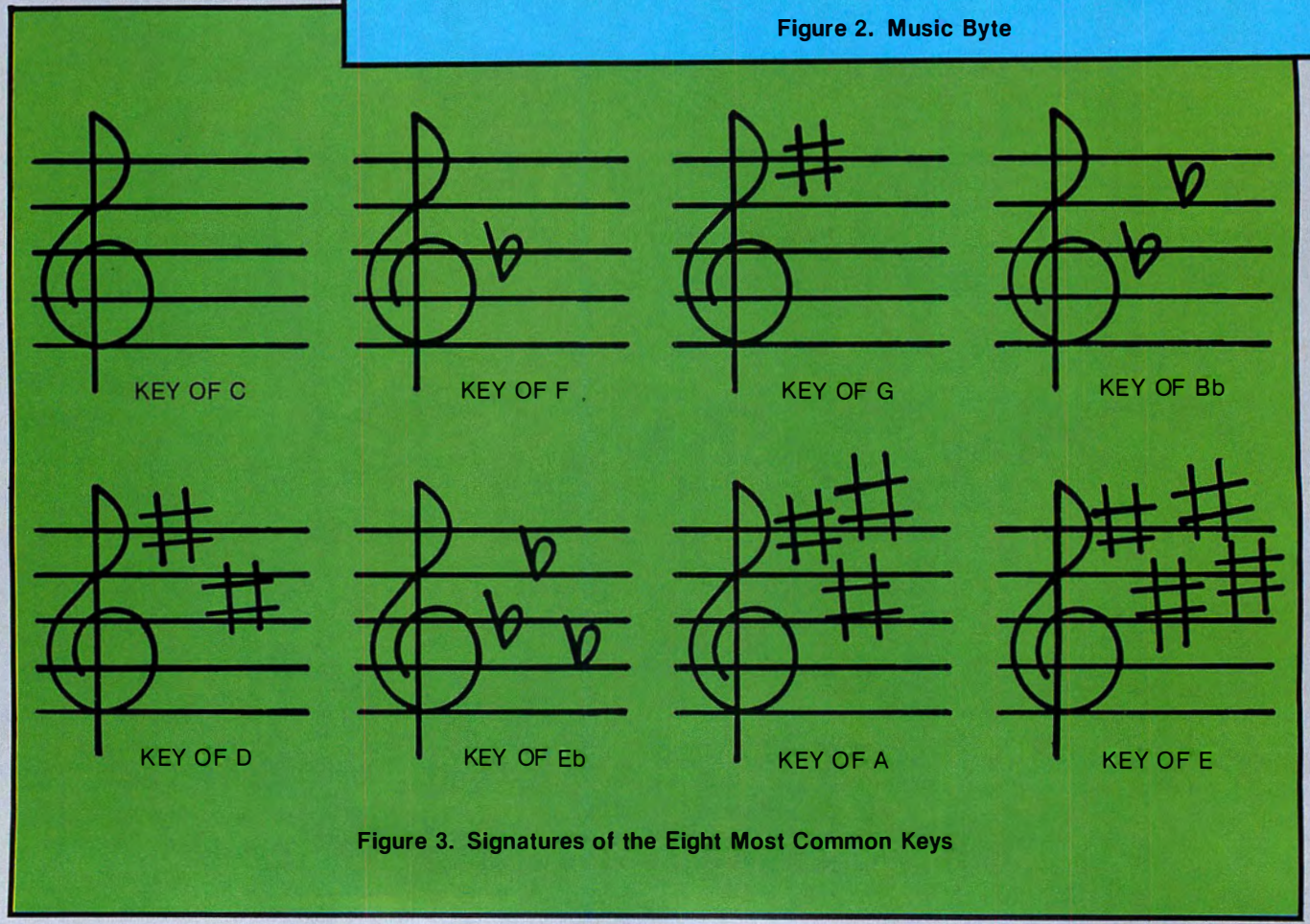


Figure 3. Signatures of the Eight Most Common Keys

times out. (A rest is played.) Note in the flow chart that only the constants for the first octave are stored. In order to generate a constant for a second octave note, the corresponding first octave constant is shifted right (divided by two) to half the period or double the frequency of the note.

NOTE: Instructions 30 through 37 actually generate the machine code for instruction 38. When the program is entered, anything can be entered for instruction 38 because by the time the CPU fetches this instruction it will have changed as a function of the note bits of the current music byte.

TURNING MUSIC INTO MUSIC BYTES

In order to assign the correct values to musical notes, it is first necessary to know in what key is the music. This is done by inspection of the "key signature" of the piece. The key signatures of the eight most commonly used keys are shown in Figure 3. If the piece you are transcribing is in the key of F, assign each occurrence of F in the piece a value of 1. You can use the scale in Figure 4 to find where the F's are. Note that there is more than one occurrence of F in the scale. Due to the nature of the music byte, however, anytime an F occurs it has a value of 1. All other notes in the song are assigned values sequentially. For example, all F's are 1, all G's are 2, all A's are 3...and all E's are 7. In order to code the note bits for a particular music byte, it is merely necessary to insert, in binary form, the value of the note into the first three bits. If a zero is placed in each of the first three bits of the music byte, a rest (no note) will be played.

The encoding of the duration of a particular note is greatly simplified by the fact that in musical notation the note duration is already in a modified binary format. For example, in a fast piece of music you will normally find half notes, quarter notes, and eighth notes. Each of these is a multiple of two of the smallest value (the eighth note). If we look at the duration bits of the music byte, we can indicate an eighth note by placing a 1 in the least significant of the duration bits. A quarter note is indicated by the second bit set, and a half note by the most significant bit set. If you see a dot appearing after a musical note, it means that its actual duration should be 1.5 times the size of the note. This is easily accomplished in our duration bits by setting the bit to the right of the normally set bit. For example, if the note you are encoding is a dotted quarter note, set the second bit to indicate a quarter note and the bit to its right (the least significant bit) to indicate that the quarter note is dotted.

The last two bits in the music byte are the octave bits. Bit 7 (see Figure 2) will always be a zero unless you wish to write more code to expand the range of the frequency synthesis generator. You will recall from the section on encoding the note bits of the music byte that even though a particular note may appear several places on the scale, that you always give it the same value. For example in the key of A, all A's have a value of 1. In order to differentiate between the two notes you must assign each to an octave. The lowest note in the tune must be in the first octave. The second octave starts with the first occurrence of the note corresponding to the key in which the music is written. For example, if you are in the key of E and the lowest note in the song is a G, then all notes between F and the lowest E in the song must be in the first octave. All notes from the E and higher must be in the second octacve. In order to indicate the first octave, set bit 6 in the music byte to a zero. To indicate that a note is in the second octave, set bit 6 to a 1.

By following the instructions above, it is possible to put any moderately fast piece of music written in any key into a form that can be played by your micro. If you wish to encode some slower music, for a whole note set the most significant of the duration bits to a 1. For a half

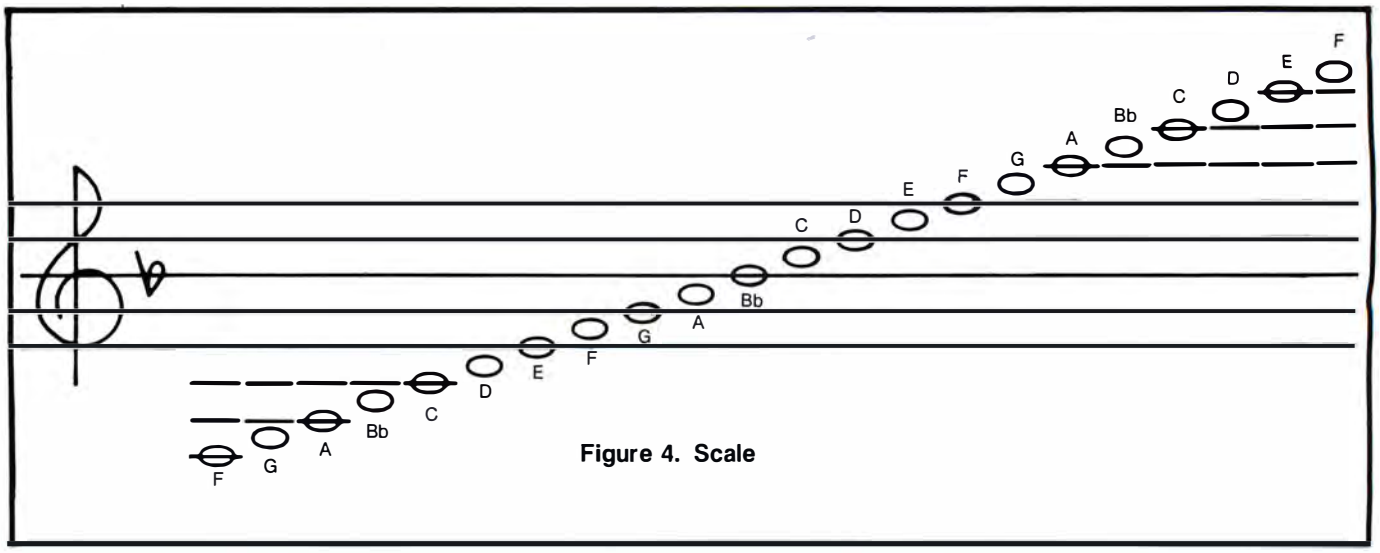
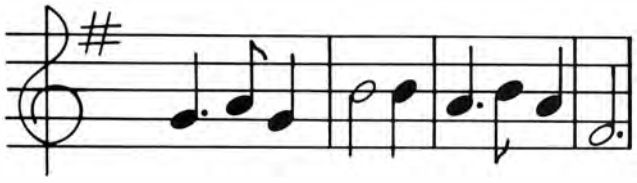


Figure 4. Scale

note set the second bit, and for a quarter note set the least significant bit. Finally decrease the tempo by replacing instruction 1F to a shift left. Now you can encode music in virtually any key at any speed as long as there are no accidentals. A short example follows for final clarification.



Note	Note Value	Note Bits	Duration Bits	Octave	Octave Bits	Music Byte
1	1	001	011	2	01	01011001 = 59
2	2	010	001	2	01	01001010 = 4A
3	1	001	010	2	01	01010001 = 51
4	3	011	100	2	01	01100011 = 63
5	3	011	010	2	01	01010011 = 53
6	2	010	011	2	01	01011010 = 5A
7	3	011	001	2	01	01001011 = 4B
8	2	010	010	2	01	01010010 = 52

First, by comparison with Figure 3, it can be seen that the piece is in the key of G. Figure 4 shows that the note G is on the second line of the staff and that the lowest note in the tune is an F#. The chart below the line of music shows the process of music byte construction step by step.

RUNNING THE PROGRAM

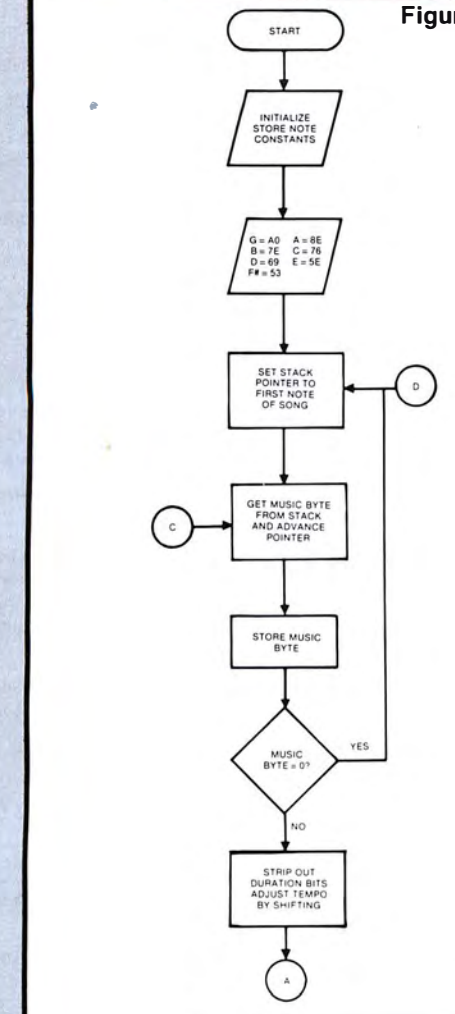
First, load the program in locations 00 through 58. Then load the tune or tunes you have converted to music bytes into locations 59 through FE. You may insert more than one tune by separating tunes with a byte of 38. This is actually a rest and will cause a pause between the tunes. After the last tune to be played, enter 00. This will be detected by the program and will cause the first tune to be restarted. Finally, run the program. If you want to see how it sounds before transcribing reams of music, try it out on one of J. S. Bach's Minuets. (See Figure 6.)

For those wishing to convert this program to a form more suitable for another type of microprocessor, it may be helpful to store the actual constants used in the frequency synthesis counter in a part of the program memory instead of the general purpose registers which you probably do not have in abundance. In addition, if you do not have a built-in serial port on your micro, you could try sending the output to the front panel and using a photoFET to couple the signal to a radio or amplifier.

Program

STEP #	MACHINE CODE	MNEMONIC	FUNCTION
00	E8	SEX8	Define Stack Pointer
01	F8	LDI	Store Constant for G in R_1.
02	A0	A0	
03	A1	PLO 1	
04	F8	LDI	Store Constant for A in R_2.
05	8E	8E	
06	A2	PLO 2	
07	F8	LDI	Store Constant for B in R_3.
08	7E	7E	
09	A3	PLO 3	
0A	F8	LDI	Store Constant for C in R_4.
0B	76	76	
0C	A4	PLO 4	
0D	F8	LDI	Store Constant for D in R_5.
0E	69	69	
0F	A5	PLO 5	
10	F8	LDI	Store Constant for E in R_6.
11	5E	5E	
12	A6	PLO 6	
13	F8	LDI	Store Constant for F# in R_7.
14	53	53	
15	A7	PLO 7	
16	F8	LDI	Put address of first note into stack
17	59	59	pointer.
18	A8	PLO 8	
19	72	LDX A	Get note and advance pointer.
1A	AA	PLO A	Store Music Byte in R_A.
1B	32	BZ	If Music Byte is zero, start tune over.
1C	16	16	
1D	FA	ANI	Strip out Duration Bits by ANDing
1E	38	38	with 38.
1F	C4	NoP	No Operation (A shift right inserted here will double the tempo. A shift left will half the tempo.)
22	FA	ANI	Strip out Note Bits by ANDing
23	07	07	with 07.
25	3A	BZ	If Note number does not equal zero, continue with program. If it does
26	30	30	equal zero, time rest interval.
27	2C	DEC C	Decrement Rest Timer.
28	C4	NoP	Mark Time.

Figure 5a. Flow Chart



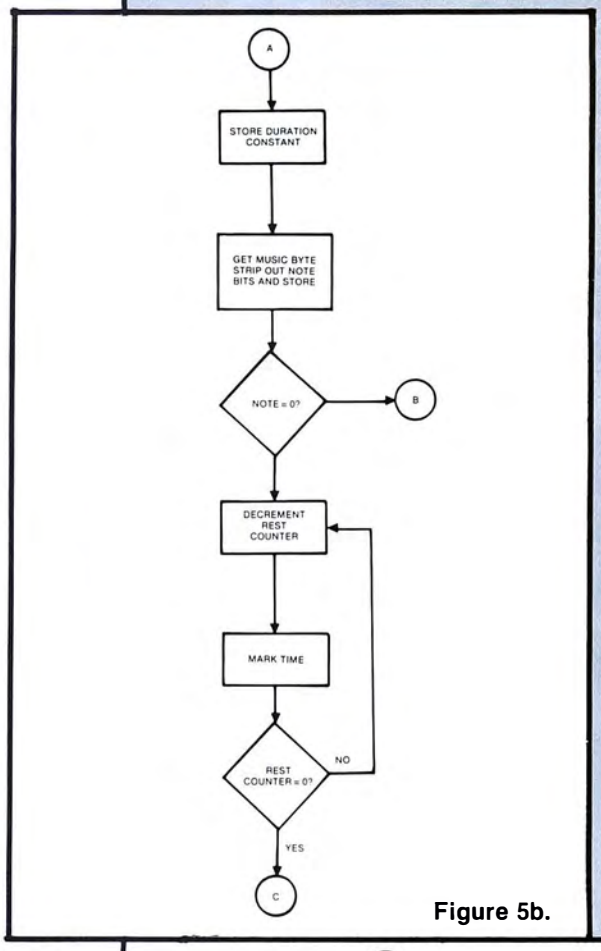


Figure 5b.

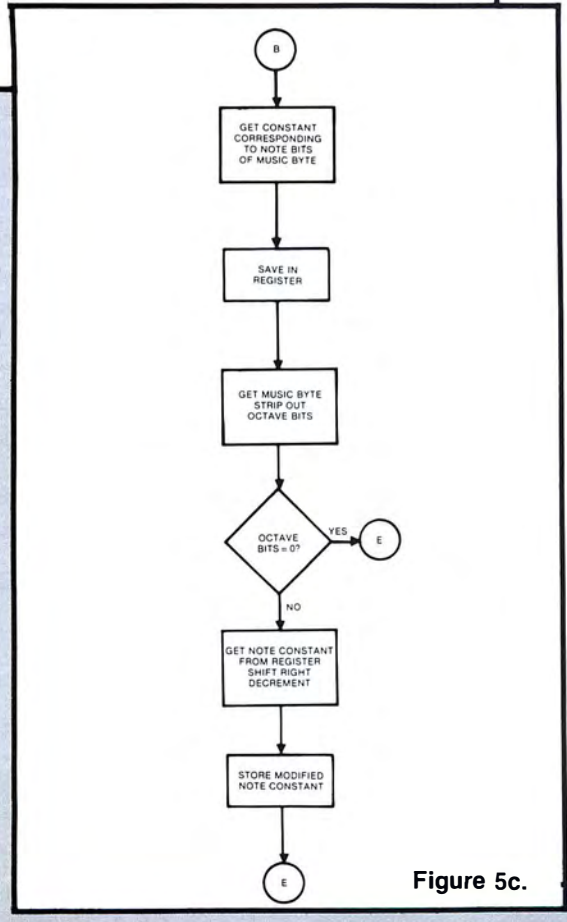


Figure 5c.

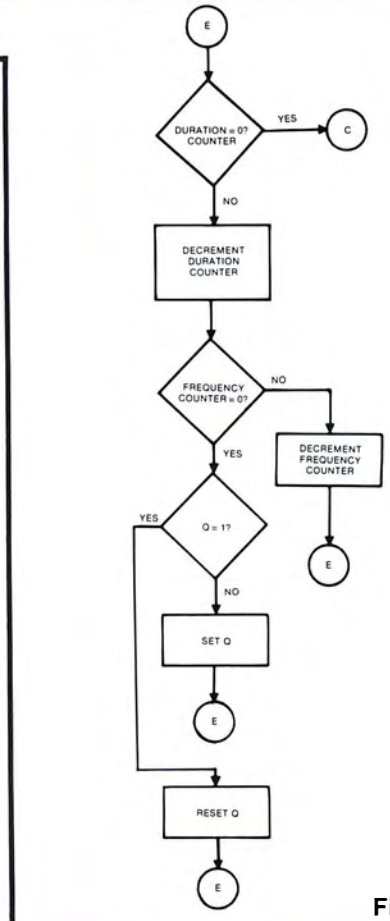


Figure 5d.

29 2A	C4 C4	NoP NoP	
2B	9C	GHI C	Get the value of the Rest Timer.
2C 2D	32 19	BZ 19	If the rest timer is done, get next note from stack.
2E 2F	30 27	Br 28	If timer is not done, loop back through.
30 31 32	F8 37 A9	LDI 37 PLO 9	Put address of machine code instruction to be generated in R_9.
33	8B	GLO B	Get Note #.
34 35	F9 80	ORI 80	Generate the machine code for instruction #37 by ORing 80 with Note # (Ex.: 80 OR 02 = 82 = machine code for Get R_2. This instruction, when executed, puts the constant for note #2 on the data bus.)
36	59	STRN	Put instruction just generated into next memory location.
37	XX	XX	Any code may be put here because the preceding seven steps will convert this location to an instruction to fetch the constant pertaining to the current note.
38	AE	PLO E	Store the constant to be used in the frequency synthesis counter in R_E.
39	8A	GLO A	Get the Music Byte.
3A 3B	FA C0	ANI C0	Strip out the octave bits by ANDing with C0.
3C	AD	PLO D	Save octave bits in R_D.
3D 3E	32 44	BZ 44	If note is in first octave, go to frequency synthesizer.
3F	8E	GLO E	Note is in second octave. Therefore, get its constant.
40	F6	SHR	Half its period. (Double its freq.)
41	AE	PLO E	Place modified constant back in R_E.
42	2E	DEC E	This step further modified constants for second octave notes to bring them into closer approximation to diatonic scale.
43	C4	NoP	Reserved.
44	8E	GLO E	Get modified note constant.
45	AF	PLO F	Make a copy.
46	9C	GHI C	Get Duration counter constant.
47 48	32 19	BZ 19	If duration counter has timed out, get next note.
49	2C	DEC C	If not, decrement timer.
4A	8F	GLO F	Get frequency synthesis counter.
4B 4C	32 50	BZ 50	If zero, go to change state of Q output.
4D	2F	DEC F	Decrement freq. synthesis counter.
4E 4F	30 46	BR 46	Branch back through loop.
50 51	31 55	BQ 55	If Q is set, go to 55.
52	7B	SEQ	Set Q.
53 54	30 44	BR 44	Go back to timing loop.
55	7A	REQ	Reset Q.
56 57	30 44	BR 44	Go back to timing loop.
58	00	00	Space.
59 60			First Note of Song Notes of Song

J.S. Bach - Minuet in G Major

15	0B	0F
09	0A	51
0A	09	11
0B	12	11
0C	09	14
15	0A	0D
11	0B	0C
11	09	0B
16	13	0A
0C	12	13
0D	12	0C
0E	15	0B
0F	09	0A
51	0A	09
11	0B	12
11	0C	0B
14	15	0A
0D	11	09
0C	11	0A
0B	16	21
0A	0C	10
13	0D	00
0C	0E	

J.S. Bach - Minuet in G Major (S. Anh. 116)

09	15	49
0B	0D	0A
0D	49	0F
49	14	51
0A	0D	11
0F	0C	11
51	0B	16
11	0C	0D
11	0B	0C
09	0A	0B
0B	22	0A
0D	09	15
49	0B	0C
0A	0D	0B
0F	49	0A
51	0A	09
11	0F	0A
11	51	0B
16	11	12
16	11	13
0E	09	31
49	0B	
15	0D	

Figure 6.

J.S. Bach - Courante from Suite I for Violoncello

50	4B	4A
51	4A	4B
15	49	4A
11	17	4B
4B	15	49
4C	15	4B
4D	0D	4A
4C	0E	4B
4B	0F	49
4A	49	0C
53	4A	4B
15	4B	4A
11	4C	49
49	4B	0F
4A	4C	4A
53	4A	4D
51	4C	0D
16	4B	51
14	4C	13
14	4C	15
4A	0D	17
4B	4C	71
4C	4B	

Figure 8.

Monti - Czardas

11	0B	0C	0B	0B	0D	0C
61	0A	0D	0C	0A	0E	0D
26	13	0C	0B	09	0D	0C
25	22	0B	0A	0A	0C	0A
13	13	0C	0B	0B	0D	09
12	32	0D	0C	0A	0E	0A
21	10	0C	0B	09	0D	0B
12	0C	0B	15	0A	0C	0C
31	0D	0C	25	0B	0D	0B
10	0E	0D	25	0A	0E	0C
09	0D	0C	25	09	0D	0D
0A	0C	0B	15	0A	0B	0E
0B	0D	0C	11	0B	0C	0D
0A	0E	0D	61	0A	0D	0C
09	0D	0C	26	13	0C	0D
0A	0C	0A	25	22	0B	0C
0B	0D	0B	13	13	0C	0D
0A	0E	0C	12	32	0D	0E
09	0D	0B	21	10	0C	0F
0A	0C	0A	12	0C	0B	61
0B	0D	0B	31	0D	0C	20
0A	0E	0C	10	0E	0D	25
09	0D	0B	09	0D	0C	
0A	0B	0A	0A	0C	0B	
					0B	

Figure 7.

General Ledger Program

—BSGLP — The Micro Bookmaker — Conclusion of Three Parts

by Bud Shamburger

FOREWORD

The General Ledger is the second of a series of software features on business application programs by Bud Shamburger. This second article covers a Motel General Ledger Software Package developed by the author for his 78-unit Ramada Inn. Part 3 of the General Ledger Software Package consists of the program listings in BASIC. Because of its size, the General Ledger Package has been published in the following three parts:

- GENERAL LEDGER PACKAGE DESCRIPTION & PROCEDURES
- GENERAL LEDGER PACKAGE OUTPUT EXAMPLES
- GENERAL LEDGER PACKAGE BASIC PROGRAMS

The General Ledger outputs include the following:

- MONTHLY BANK STATEMENT
- GENERAL JOURNAL
- BALANCE SHEET & OPERATING STATEMENT
- MONTHLY BUDGET
- YTD BUDGET
- MONTHLY STATISTICAL REPORT
- YTD STATISTICAL REPORT
- YEAR TO YEAR INCOME & EXPENSE COMPARISONS
- AVERAGE DAILY ROOM RATES MONTHLY & YTD
- OCCUPANCY RATES MONTHLY & YTD
- CASH FLOW ANALYSIS
- SPECIAL SORT PROGRAM WHICH REARRANGES THE DATA FILES TO PRODUCE THE ABOVE REPORTS

The General Ledger Software Package includes the following BASIC programs:

- CHECK TRANSACTIONS
- LEDGER TRANSACTION
- MERGE BANK BACKUP WITH LEDGER & CREATE NEW BANK CURRENT
- CHECKS CASHED & TAG BANK CURRENT
- BANK STATEMENT
- DAILY ROOM REVENUE JOURNAL VOUCHERS
- MONTHLY OR YTD BUDGET — MONTHLY OR YTD ANALYSIS
- COPY FILES
- MAKE MASTER CHANGES
- SORT GENERAL LEDGER FILES
- COPY BUDGET FILE TO BUDGET HISTORY FILE
- LOADS IN GENERAL LEDGER CHART OF ACCOUNTS
- LIST THE PROCEDURES FOR RUNNING THE GENERAL LEDGER PACKAGE OF PROGRAMS
- DISPLAY ALL GENERAL LEDGER PROGRAMS AND PROMPTS THE OPERATOR AS TO THE FLOW OF PROCESSING

The author's microcomputer hardware system configuration includes:

- MITS ALTAIR™ 8080B MICROCOMPUTER WITH 64K MEMORY, 4 SIO PORTS, 2 PIO PORTS & PROM BOOTSTRAP LOADER
- TWO MITS ALTAIR™ HARD SECTORED FLOPPY DISC DRIVES
- TWO ADM3 VIDEO TERMINALS
- ONE OKIDATA 110 LINE PRINTER
- ONE MPI LINE PRINTER
- MITS 12K DISC BASIC VER. 4.0

Now to Bud's General Ledger Software Package.

—Software Editor

SUMMARY OF GENERAL LEDGER PROGRAMS

Fourteen BASIC programs make up the General Ledger Package. These programs are as follows:

- **•GLMENU** Display all General Ledger Programs and prompts the operator as to the flow of processing.
- **•GL1** Enter Check Transactions for Account 1110
- **•GL2** Run Ledger Transactions by:
  A. Check No. - Voucher No.
  B. Account No.
- **•GL3** Merge BANKBKUP with ledger and create new BANKCURR
- **•GL4** Enter checks cashed and tag BANKCURR
- **•GL5** Run Bank Statement for Account No. 1110
- **•GL6** Enter Daily Room Revenue Journal Vouchers
- **•GL7** Run Monthly or YTD Budget — Monthly or YTD Analysis
- **•COPRAN** Copy Files
- **•GETPUT** Make Master Changes
- **•SORTGL** Sort General Ledger Files
- **•COPCON** Copy Budget File to Budget History File
- **•CHART** Loads General Ledger Chart of Accounts in program format for listing or updating
- **•GENPRO** List the procedures for running the General Ledger Package of Programs

GENERAL LEDGER PROGRAM LISTINGS

Program GLMENU

This is a system operator prompt and boot-up program which boots up the desired program selected by the operator. All programs in the system in turn boot up this program upon reaching end of job.

```
10 ' PROGRAM NAME - "GLMENU"
20 ' PROGRAMMED BY:     BUD SHAMBURGER       JANUARY 1977
30 '
40 '
50 '
60 '
70 ' A PROGRAM TO DISPLAY ALL GENERAL LEDGER PROGRAMS AND PROMPT THE
80 ' OPERATOR AS TO THE FLOW OF PROCESSING
90 '  THIS PROGRAM BOOTS UP THE DESIRED PROGRAM SELECTED BY THE OPERATOR
100 ' EACH PROGRAM IN THE GENERAL LEDGER PACKAGE WILL BOOT UP THIS PROGRAM
110 ' UPON REACHING EOJ.
120 '
130 '*************************************************************************
140 '
150 PRINT " * *  GENERAL LEDGER MENUE  * *"
160 PRINT
170 PRINT "       ENTER NUMBER DESIRED"
180 PRINT
190 PRINT "1 - GL1 - ENTER CHECK TRANSACTIONS FOR ACCOUNT 1110"
200 PRINT "2 - GL2 -  RUN LEDGER TRANSACTIONS BY."
210 PRINT "              A.  CHECK NO - VOUCHER NO"
220 PRINT "              B.  ACCOUNT NO"
230 PRINT "3 - GL3 - MERGE BANKBKUP WITH LEDGER AND CREATE NEW BANKCURR"
240 PRINT "4 - GL4 - ENTER CHECKS CASHED & TAG BANKCURR"
250 PRINT "5 - GL5 - RUN BANK STATEMENT FOR ACCOUNT NO 1110"
260 PRINT "6 - GL6 - ENTER DAILY ROOM REVENUE JOURNAL VOUCHERS"
270 PRINT "7 - GL7 - RUN MONTHLY OR YTD BUDGET - MONTHLY OR YTD ANALYSIS"
280 PRINT "8 - COPRAN - COPY FILES"
290 PRINT "9 - GETPUT - MAKE MASTER CHANGES"
300 PRINT "10 - SORTGL - SORT GENERAL LEDGER FILES"
310 PRINT "11 - COPCON - COPY BUDGET FILE TO BUDGET HISTORY FILE"
320 PRINT "12 - CHART - LOADS GENERAL LEDGER CHART OF ACCOUNTS IN"
330 PRINT "              PROGRAM FORMAT FOR LISTING OR UPDATING"
340 PRINT "13 - GENPRO - LIST THE PROCEDURES FOR RUNNING THE GENERAL"
350 PRINT "              LEDGER PACKAGE OF PROGRAMS"
360 INPUT A
370 IF A<1 OR A>13 THEN PRINT "CODE ERROR";CHR$(7): GOTO 150
380 IF A=1 THEN LOAD "GL1",0,R
390 IF A=2 THEN LOAD "GL2",0,R
400 IF A=3 THEN LOAD "GL3",0,R
410 IF A=4 THEN LOAD "GL4",0,R
420 IF A=5 THEN LOAD "GL5",0,R
430 IF A=6 THEN LOAD "GL6",0,R
440 IF A=7 THEN LOAD "GL7",0,R
450 IF A=8 THEN LOAD "COPRAN",0,R
460 IF A=9 THEN LOAD "GETPUT",0,R
470 IF A=10 THEN LOAD "SORTGL",0,R
480 IF A=11 THEN LOAD "COPCON",0,R
490 IF A=12 THEN LOAD "CHART",0
500 IF A=13 THEN LOAD "GENPRO",0,R
510 GOTO 150
520 END
```

Figure 23b. GLMENU Program Listing

Program GL1

This program enters and edits the information from the source documents. It edits the information for obvious errors, prints a hard copy on the line printer, and verifies that the debits equal credits. You may correct an individual line or re-enter the entire document. If you make a mistake in the middle of a line, simply hit / or return. The program will let you re-enter the line. Should the debits be greater or less than the credits, you may examine the hard copy print out, select a line number, and re-enter one line over again. You can continue to re-enter one line until the debits equal the credits. You may enter un-balanced entries if you desire. This is nice for correcting a disc error without having to delete and re-enter much data. It will happen. You will get data on the disc and the debits will not equal the credits. Simply make a one-sided entry for the difference.

You can also use this program to enter new account headers. Give them -0- money amounts. I used it initially to enter my beginning ledger account header/balance forwards.

The pause after the first document has been entered is the computer locating the file in question and going to the EOF record in the file:

```
10 ' PROGRAM NAME "GL1"
20 ' MITS BASIC VERSION 4.0
30 ' PROGRAMMED BY:   BUD SHAMBURGER      DECEMBER 1976
40 '
50 '
60 '
70 ' THIS IS THE INITIAL PROGRAM OF A 7 SERIES GENERAL LEDGER PACKAGE
80 ' WHICH MAINTAINS A COMPLETE BOOKKEEPING SYSTEM AND PRODUCES BALANCE
90 ' SHEETS, OPERATING STATEMENTS, BUDGETS, INCOME AND COST ANALYSIS,
100 ' CHECK AND VOUCHER REGISTERS AND BALANCES BANK STATEMENTS.
110 '
120 ' A PROGRAM TO ENTER AND EDIT GENERAL LEDGER TRANSACTIONS FROM
130 ' CHECK STUBS (OR COPIES) AND JOURNAL VOUCHERS.   THE FILE IS A
140 ' RANDOM FILE RESIDING ON DR 1.   THIS PROGRAM OUTPUTS THE TRANSACTIONS
150 ' TO FILE "LEDGER".   "LEDGER" OCCUPIES THE ENTIRE FLOPPY RANDAM AREA
160 ' ALLOTED BY MITS BASIC, IE RECORDS 0001 - 2036.   RECORD 2037 IS RESERVED
170 ' FOR A SPECIAL TABLE WHICH CONTAINS THE LEDGER MONTH & YEAR AND THE
180 ' BEGINNING RECORD ADDRESS FOR THAT DATE.
190 '
200 ' ALL PROGRAMS IN THE LEDGER PACKAGE, IE GL1 - GL7 REFERENCE THIS TABLE
210 ' FOR BOTH INPUT AND OUTPUT TO DETERMINE THE FILE BOUNDARIES FOR A
220 ' PARTICULAR MONTHS LEDGER.   'LEDGER' IS A BLOCKED FILE WITH EACH
230 ' DISK RECORD CONTAINING THREE (3) LEDGER TRANSACTIONS.
240 ' THIS GIVES ONE FLOPPY THE ABILITY TO HOLD 6,108 LEDGER RECORDS OR
250 ' AN AVERAGE OF 509 TRANSACTIONS PER MONTH FOR A TWELVE (12) MONTH PERIOD.
260 '
270 ' EACH MONTHS LEDGER IS STACKED IN THIS LARGE HISTORY FILE, IMMEDIATELY
280 ' FOLLOWING LAST MONTHS FILE.   EACH MONTH ON THE FLOPPY IS SEPARATED
290 ' BY AN 'EOF' RECORD.   THE FIRST ENTRIES IN A NEW MONTHS FILE ARE
300 ' ALWAYS THE BALANCE FORWARD-ACCOUNT HEADERS.   THESE ARE GENERATED
310 ' WHEN RUNNING 'GL2' IN THE LIST MODE.
320 '
330 ' THIS FLOPPY WILL ALSO CONTAIN THIS MONTHS BUDGET FILE AS OUTPUT BY
340 ' GL2.   'BUDGET' IS A CONSECTIVE FILE OCCUPYING THE TAIL END OF THE
350 ' FLOPPY.
360 '
370 'THE GENERAL LEDGER PACKAGE IS CURRENTLY BEING RUN ON THE FOLLOWING SYSTEM:
      A. ALTAIR 8800B, SIO, PIO, PROM BOOTSTRAP LOADER
      B. 2 ALTAIR DISK DRIVES
      C. 1 ADM3K
      D. 1 OKIDATA 110 LINE PRINTER
380 ' THE PACKAGE REQUIRES ONLY 48K OF THE ABOVE 64K TO RUN WITHOUT ANY
390 ' CHANGES, PROVIDED ALL THE ABOVE HARDWARE REMAINS THE SAME.
400 '
410 '
420 'MINIMUM HARDWARE REQUIREMENTS FOR THE GENERAL LEDGER PACKAGE USING
430 'MITS BASIC VER 3.4 OR VER 4.0 = 28K, HARDCOPY PRINTER(TERMINAL)
                                    1 DISK DRIVE & REMOVAL
                                    OF ALL REMARKS & SPACES
                                    FROM PROGRAM.  3.4 USERS
440 '                               SHOULD BE AWARE OF 4.0
                                    CHANGES, IE; NEW INSTRUCTIONS
450 '
460 '*************************************************************************
470 '*************************************************************************
480 '
490 CLEAR 1500
500 INPUT "ENTER -Y TO MOUNT THE FILE";WY$
510 IF WY$<>"Y" THEN 530
520 UNLOAD 1:MOUNT 1
530 DIM B$(100)   ' MATRIX FOR TRANSACTIONS
535 DIM I1(16)
540 R$="R" F=1 D=1 BK$=" " ZER$=" "
550 GL$="LEDGER"
560 PRINT "ENTER GENERAL LEDGER TRANSACTIONS"
570 PRINT
580 '
590 ' ****** SELECT TYPE OF TRANSACTION TO ENTER ****
600 '
610 PRINT "ENTER -1- FOR HEADERS & BAL FWDS"
620 PRINT "ENTER -2- FOR CHECK TRANSACTIONS"
630 PRINT "ENTER -3- FOR VOUCHER TRANSACTIONS"
640 INPUT TY$
650 '
660 '  ****** IF DEBITS DO NOT EQUAL CREDITS - ENTER 'U' ******
670 ' ****** YOU MAY ENTER ONE-SIDED ENTRIES FOR ERROR CORRECTION ETC ******
680 '
690 INPUT "ENTER -U- FOR UNBALANCED ENTRIES";U$
700 IF TY$="3" THEN TY$="2" T#="V" GOTO 730
710 IF TY$="2" THEN T$="C" GOTO 730
720 IF TY$="1" THEN 730 ELSE 690
730 INPUT "ENTER TRANSACTION MO & YR AS - MOYR";GD$
740 PRINT "100 ENTRIES MAX PER CHECK OR VOUCHER"
750 PRINT "ENTER -T- TO TOTAL TRANSACTIONS"' END OF CHECK OR VOUCHER
760 PRINT "ENTER -L- FOR LAST TRANSACTION" ' ALL TRANSACTIONS ENTERED
770 OPEN R$,F,GL$,D   ' OPEN LEDGER FILE
780 A=2037            ' GET TABLE TO DETERMINE FILE START
790 GET #1,A
800 FOR I=1 TO 16     ' SEARCH TABLE FOR CORRECT MONTH & YEAR
810 FIELD #1, (I1-1)*8 AS D$, 8 AS D1$(I)
820 IF GD$=MID$(D1$(I),1,4) THEN 860  ' THIS IS CORRECT MONTH & YEAR
830 NEXT I
840 PRINT "NO FILE ADDRESS IN TABLE"
850 GOTO 850
860 REC$=MID$(D1$(I),5,4)   ' LOAD FILE ADDRESS FROM TABLE
870 REC=VAL(REC$)
880 GET #1,REC              ' GET FIRST RECORD
890 IF TY$="1" THEN 1970    ' IS IT A BALANCE FORWARD RECORD
900 '
910 ' ****** SET UP TERMINAL HEADINGS FOR TERMINAL INPUT ******
920 '
930 T#=0                    ' COUNTER FOR DEBITS & CREDITS
940 H1$="   TRANS ACCT C/V                          AMOUNT"
950 H2$="  MODYYR NUMB NUMB DESCRIPTION...-$$$,$$$.$$"
960 S1=0                    ' RE-SET ERROR SWITCH
970 I=1
980 FOR I=1 TO 100   FILE ENTRIES - 100 - MAX
990 PRINT H1$
1000 PRINT H2$
1010 INPUT A$        ' DATA INPUT LINE
1020 '
1030 '****** EDIT DATA ENTERED FOR ERRORS ** ***
1040 '
1050 IF MID$(A$,1,1)="T" THEN 1300  ' TO TOTAL CHECK OR VOUCHER
```

```
1060 IF MID$(A$,1,1)="L" THEN 1300 ' LAST ENTRY MADE
1070 IF MID$(A$,(LEN(A$)))="/" THEN 990
1080 IF MID$(A$,1,2)<"01" OR MID$(A$,1,2)>"13" THEN 1800
1090 IF MID$(A$,3,2)<"01" OR MID$(A$,3,2)>"31" THEN 1800
1100 IF MID$(A$,5,2)<"76" THEN 1800
1110 IF MID$(A$,7,1)>="1" THEN 1800
1120 IF MID$(A$,12,1)>="1" THEN 1800
1130 IF TY$="1" THEN 2030
1140 IF MID$(A$,17,1)>="1" THEN 1800
1150 IF MID$(A$,33,1)="-" THEN 1180
1160 IF MID$(A$,33,1)<"1" THEN 1180
1170 GOTO 1800
1180 IF MID$(A$,37,1)=" " THEN 1210
1190 IF MID$(A$,37,1)<"1" THEN 1210
1200 GOTO 1800
1210 IF MID$(A$,41,1)<>" " THEN 1800
1220 '
1230 '****** CHECK FOR HIGHEST POSSIBLE ACCOUNT NUMBER ******
1240 '
1250 IF MID$(A$,8,4)>"7904" OR MID$(A$,8,4)<"1000" THEN 1800
1260 '
1270 IF LEN(A$)<>43 THEN 1800
1280 L=L+1
1290 LPRINT A$;SPC(5) USING "##";L  ' PRINT OUT LINE NUMBER
1300 IF A$="T" OR A$="L" THEN 1910
1310 IF TY$="1" THEN 2190
1320 '
1330 '****** LOAD MATRIX - CHECK AND VOUCHERS ******
1340 '
1350 B$(I)=MID$(A$,1,6)+MID$(A$,8,4)+T$+MID$(A$,13,4)
1360 B$(I)=B$(I)+MID$(A$,18,16)+ZER$+MID$(A$,34,3)
1370 B$(I)=B$(I)+MID$(A$,38,3)+MID$(A$,41,3)+TY$
1380 C$=MID$(A$,33,4)+MID$(A$,38,3)+MID$(A$,41,3)
1390 TT#=VAL(C$)
1400 T#=T#+TT#
1410 IF S1=1 THEN 1450    ' CHECK ERROR SWITCH
1420 NEXT I
1430 PRINT "ERROR TO MANY TRANSACTIONS";CHR$(7);CHR$(7);CHR$(7);CHR$(7)
1440 GOTO 490
1450 PRINT SPC(32) USING "$#,###,###.##-";T# ' PRINT OUT TOTAL DEBITS & CREDITS
1460 LPRINT SPC(38) USING "$#,###,###.##-";T#
1470 LPRINT
1480 L=0
1490 IF U$="U" THEN T#=0:GOTO 1660
1500 IF T#<-.01# AND T#>-.01# THEN 1660' DR = CR GO TO PUT DISK
1510 '
1520 '****** OPTIONAL LINE CORRECTION ROUTINE ******
1530 '****** LINE PRINTER NECESSARY                ******
1540 '
1550 PRINT "TO RE-START, GOTO RUN"
1560 INPUT "*** ERROR *** DR<>CR-ENTER ERROR LINE #";LN
1570 I=LN
1580 S1=1                 ' TURN ERROR SWITCH ON
1590 E$=MID$(B$(I),31,11)
1600 TT#=VAL(E$)
1610 T#=T#-TT#
1620 GOTO 1010
1630 '
1640 '****** PROCESS AND WRITE OUT THIS TRANSACTION ******
1650 '
1660 FOR I=1 TO 100
1670 T#=0
1680 IF B$(I)="T" THEN 890'  END OF THIS TRANSACTION
1690 GOSUB 2270
1700 NEXT I
1710 GOTO 1430
1720 LSW=1                ' TURN LAST RECORD SWITCH ON
1730 GOSUB 2270           ' GO PROCESS LAST RECORD
1740 CLOSE 1              ' CLOSE LEDGER FILE
1750 PRINT "EOJ"          ' PRINT END OF JOB MESSAGE
1760 LOAD "GLMENU",0,R
1770 '
1780 ' ****** DATA ENTRY ERROR - RE-ENTER DATA ******
1790 '
1800 PRINT CHR$(7);CHR$(7);CHR$(7);CHR$(7);CHR$(7);CHR$(7)
1810 A$=ZZ$               ' CLEAR INPUT AREA TO BLANKS
1820 GOTO 990
1830 '
1840 '
1850 CLOSE 1
1860 UNLOAD 1
1870 PRINT "END OF DISK ERROR  THIS SHOULD NEVER OCCUR USING THIS"
1880 PRINT "PROGRAM  GL2 CHECKS TO MAKE SURE THERE IS ALWAYS ROOM"
1890 PRINT "FOR A ENTIRE MONTHS FILE."
1900 STOP
1910 IF A$="L" THEN 1720'  LAST TRANSACTIONS TO PROCESS
1920 B$(I)=A$
1930 GOTO 1450
1940 '
1950 '****** SET UP TERMINAL LINE FOR ACCOUNT HEADER ******
1960 '
1970   H1$="   TRANS ACCT                                AMOUNT "
1980   H2$="  MODYYR NUMB ACCOUNT HEADER.....-$,$$$,$$$.$$"
1990 GOTO 960
2000 '
2010 '****** EDIT BALANCE FORWARD - ACCOUNT HEADER ENTRIES ******
2020 '
2030 IF MID$(A$,33,1)="-" THEN 2060
2040 IF MID$(A$,33,1)<"1" THEN 2060
2050 GOTO 1800
2060 IF MID$(A$,35,1)=" " THEN 2090
2070 IF MID$(A$,35,1)<"1" THEN 2090
2080 GOTO 1800
2090 IF MID$(A$,39,1)=" " THEN 2120
2100 IF MID$(A$,39,1)<"1" THEN 2120
2110 GOTO 1800
2120 IF MID$(A$,43,1)<>" " THEN 1800
2130 IF MID$(A$,8,4)>"7904" OR MID$(A$,8,4)<"1000" THEN 1800
2140 IF LEN(A$)<>45 THEN 1900
2150 GOTO 1280
2160 '
2170 '****** LOAD MATRIX - BALANCE FORWARD-ACCOUNT HEADERS ******
2180 '
2190 B$(I)=MID$(A$,1,6)+MID$(A$,8,4)+MID$(A$,13,20)
2200 B$(I)=B$(I)+MID$(A$,33,2)+MID$(A$,36,3)+MID$(A$,40,6)
2210 B$(I)=B$(I)+TY$
2220 C$=(MID$(A$,33,2))+(MID$(A$,36,3))+(MID$(A$,40,6))
2230 GOTO 1390
2240 '
2250 '****** LOAD DISK OUTPUT AREA ******
2260 '
2270 FOR M=1 TO 3
2280 FIELD #1, (M-1)*42 AS D$,42 AS D1$(M)
2290 '
2300 '****** DOES WRITE SWITCH = 1.  ARE MONTHS =. HAS EOF BEEN READ, ******
2310 '****** AND IS RECORD BLANK.  IF SO WRITE IT OUT HERE ******
2320 '
2330 IF WSW=1 AND MID$(B$(I),1,2)<>MID$(D1$(M),1,2) THEN 2410
2340 IF MID$(D1$(M),1,3)="EOF" THEN 2410  ' END OF THIS MONTHS BAL FWDS  YET
2350 IF MID$(D1$(M),1,3)<"001" THEN 2410  ' IS IT BLANK
2360 NEXT M
2370 REC=REC+1              INCREMENT RECORD COUNTER
2380 IF REC=2027 THEN 1850  ' DISK ERROR
2390 GET #1,REC              READ NEXT DISK RECORD
2400 GOTO 2270
2410 IF LSW=1 THEN 2460   LAST RECORD SWITCH
2420 WSW=1              EOF READ - OK TO START WRITING IF BLANK
2430 RSET D1$(M)=MID$(B$(I),1,42)
2440 PUT #1,REC          ' WRITE OUT DISK RECORD
2450 RETURN
2460 LSET D1$(M)="EOF"   ' SET UP TO WRITE OUT 'EOF'
2470 GOTO 2440
2480 END
```

Figure 24. GL1 Program Listing

Program GL2

This program produces: a) The Check/Voucher Register; b) The General Ledger; c) The Balance Sheet;

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d) It can also be used to tab an account number for a month-to-date total, i.e. the bank account.

You can run the general ledger with or without producing new balances for next month. This is nice when you wish to go back and re-run an old month's report for some reason. Maybe you need an extra copy. You can also run the ledger with or without producing the budget file. This is nice for the same reasons. Or perhaps you need to reconstruct the budget for an old month. You can run the ledger without new balances but produce the budget file.

One thing you can't do. You cannot tab the Ledger Detail file. When you request TAB, you get the new balances for next month's ledger. The answers will be the same and the time consumed will be less, but it would be nice to TAB the Check/Voucher Register without having to list it.

Remember, when the program asks for a period ending date, that's the file the computer will always access.

```
10 ' PROGRAM NAME "GL2"
20 ' MITS BASIC VERSION 4.0
30 ' PROGRAMMED BY  BUD SHAMBURGER       DECEMBER 1976
40 '
50 '
60 '
70 ' A MULTI-PURPOSE PROGRAM TO RUN LEDGER TRANSACTIONS BY
80 '      1.  CHECK OR VOUCHER NUMBER
90 '          A.  TOTAL BY CHECK OR VOUCHER NUMBER WITH FINAL TOTALS
100 '       2.  LEDGER ACCOUNT NUMBER
110 '           A.  TOTALS BY ACCOUNT NUMBER
120 '           B.  TOTALS BY SUB-CLASSIFICATION
130 '           C.  TOTALS BY ASSETS, LIABILITIES, FINAL
140 '           D.  TOTALS BY INCOME, EXPENSE, FINAL
150 '
160 ' WHEN LISTING BY ACCOUNT NUMBER, NEW BAL FWDS MAY BE OUTPUT FOR NEXT
170 ' MONTH AND THE MONTHLY 'BUDGET' FILE MAY BE OUTPUT FOR THE CURRENT
180 ' MONTH.   WHEN TABING BY ACCOUNT #, THE DATE ENTERED IS INCREASE BY ONE
190 ' (1) MONTH TO GET THE NEW BAL FORWARDS.   YOU CANNOT TAB THE CURRENT
200 ' MONTHS DETAIL FILE BY ACCOUNT NUMBER.   THE BUDGET MAY BE OUTPUT WITH-
210 ' OUT OUTPUTTING NEW BALANCE FORWARDS.
220 '
230 ' 'LEDGER' IS A RANDOM FILE RESIDING ON DR 1 AS OUTLINED IN 'GL1'
240 '
250 ' THE DATA ENTRIES CONTAINED IN THE PROGRAM REFLECT THE ACCOUNT NUMBER
260 ' AND THE MONTHLY DEPRECIATION FIGURE FOR FIXED ASSETS AS DETERMINED
270 ' BY GENERALLY ACCEPTED ACCOUNTING PRINCIPLES.   THEY ARE USED TO
280 ' AUTOMATICALLY GENERATE THE MONTHLY TRANSACTION ENTRIES FOR THE
290 ' PROPER ACCUMULATED DEPRECIATION ACCOUNT.
300 '
310 ' THE HARDWARE REQUIREMENTS FOR THIS PROGRAM ARE THOSE AS OUTLINED
320 ' IN 'GL1'.   REFER TO 'GL1' FOR THE FILE STRUCTURE.
330 '
340 CLEAR 1500
350 INPUT "TO MOUNT THE FILE ENTER-Y-";WY$
360 IF WY$<>"Y" THEN 390
370 UNLOAD 1
380 MOUNT 1
390 ED$="##,###,###.##-                ##,###,###.##-"   ' LINE EDIT WORD
400 '
410 '****** MONTHLY DEPRECIATION DATA FOR FIXED ASSETS ******
420 '****** ACCOUNT NUMBER,DEPRECIATION DATA ******
430 '
440 DATA 1202,-00003520.67,1206,-00001681.75,1214,-00000345.33
450 DATA 1224,-00000165.17,1228,-00000108.00,7903,00005820.92
460 '
470 R$="R"          ' A RANDOM FILE
480 F=1             ' FILE NUMBER
490 GL$="LEDGER"    ' FILE NAME
500 D=1             ' DRIVE NUMBER FOR CURRENT LEDGER FILE
510 A=2037          ' DATA TABLE LOCATION
520 EDT$="##,###,###.##-"   ' EDIT WORD
530 BK$=" "                           ' SAVE A BLANK
540 I5=1                              ' FOR NEXT LOOP RECORD LOCATION
550 NO$="1":OK$="-"
560 BLK$="                            "   ' RESERVED BLANKS
570 Z1E$="-00000000"                  ' ZEROS FOR SETTING UP DISK AREA
580 Z2E$="+00000000"
590 CENT$=".00"
600 DR=1                              ' DRIVE NUMBER FOR TABLE & BUDGET
610 DIM K(16)       ' MATRIX FOR DISK DATA TABLES
620 '
630 '****** SET UP REPORT HEADING INFO  ***
640 '
650 H1$="  DATE    ACCT NUMB"
660 I1$="MONTHLY          MONTHLY          Y.T.D."
670 H2$="MO DY YR NUMB VNUMB DESCRIPTION"
680 I2$=" DEBITS        CREDITS          BALANCE"
690 H3$="   CONWAY R.I.  INC.,  CONWAY ARK"
700 H4$="GENERAL LEDGER - UNAUDITED - PERIOD ENDING "
710 H7$="BALANCE SHEET - UNAUDITED - PERIOD ENDING "
720 H8$="OPERATING STATEMENT - UNAUDITED - PERIOD ENDING "
730 H5$="PAGE "
740 H6$="-------------------------------------------"
750 '
760 '****** OPEN ALL FILES ******
770 '
780 OPEN R$,F,GL$,D
790 OPEN R$,2,GL$,DR
800 OPEN R$,3,GL$,DR
810 '
820 '****** WHAT KIND OF REPORT IS DESIRED ******
830 '
840 PRINT "GENERAL LEDGER"
850 INPUT "ENTER PERIOD ENDING DATE AS MO-DY-YR",DT$
860 GD$=MID$(DT$,1,2)+MID$(DT$,7,2)
870 INPUT "ENTER-Y-IF YOU WANT CLOSING ENTRIES",CE$
880 IF CE$="Y" THEN CLOSE 2:DR=0:OPEN R$,2,GL$,DR
890 INPUT "ENTER -SR- TO TABULATE AN ACCOUNT NUMBER";SR$
900 IF SR$="SR" THEN INPUT "ENTER -ACCOUNT NUMBER- DESIRED";AC$
910 IF SR$="SR" THEN H4$="* * * ";AC$;" * * *"
920 IF SR$="SR" THEN GOSUB 3160:GOSUB 2720:GOTO 1140
930 INPUT "ENTER -T- FOR TAB, -L- FOR LIST",TL$
940 IF TL$="T" OR TL$="L" THEN 960
950 GOTO 930
960 PRINT SPC(5);"** ENTER **"
970 PRINT "1-FOR CTL ON CK OR VUCH#"
980 PRINT "2-FOR CTL ON ACCOUNT #"
990 INPUT CT$
1000 IF CT$="1" THEN H4$="CHECK/VOUCHER REGISTER - PERIOD ENDING "
1010 IF CT$="1" OR CT$="2" THEN 1030
1020 GOTO 970
1030 IF CT$="1" THEN GOSUB 2720:GOSUB 3160:GOTO 1140' PRINT HEADINGS
1040 IF TL$="T" AND CT$="2" THEN 6530' GO ADD 1 TO MONTH
1050 INPUT "ENTER -Y- TO GENERATE NEW BAL FWDS";BL$
1060 IF BL$="Y" THEN 1100
1070 INPUT "ENTER-B-TO GENERATE BUDGET TOTALS";BU$
1080 IF BU$<>"B" THEN 1110
1090 '
1100 OPEN "O",4,"BUDGET":DR
1110 GOSUB 2720   'GO GET FILE START FROM TABLE IN SECTOR 2037
```

```
1120 GOSUB 3160          PRINT MAIN HEADINGS & SUB HEADINGS
1130 LPRINT "ASSETS" LPRINT LPRINT "CURRENT ASSETS" LCT=LCT+3
1140 GOSUB 3260          GET DISK RECORD FROM FILE
1150
1160  ****** LOAD WORK AREAS FROM DISK FILE ******
1170
1180 DM0$=MID$(DREC$(I),1,2)
1190 DD%=MID%(DREC$(I),3,2)
1200 DY%=MID%(DREC$(I),5,2)
1210 CC%=MID%(DREC$(I),11,5)
1220 DSC$=MID$(DREC$(I),16,15)
1230 DAC$=MID$(DREC$(I),31,4)
1240 DOL$=MID$(DREC$(I),31*11)
1250 IF SR$="SR" AND DAC$<>AC$ THEN 1140
1260 T#=VAL(DOL$)
1270 SN=SGN(T#)
1280 IF MID$(DREC$(I),42,1)<>"1" AND SN=-1 THEN 7210 'GO ADD TO CREDIT COUNTER
1290 IF MID$(DREC$(I),42,1)<>"1" THEN 7270  'GO ADD TO DEBIT COUNTER
1300 IF MID$(DREC$(I),42,1)<>"1" AND MID$(DAC$,1,1)="7" THEN 1560 ' BUDGET
1310 T1#=T1#+T#                  ADD TO YTD COUNTERS
1320 T2#=T2#+T#
1330 T3#=T3#+T#
1340 T4#=T4#+T#
1350 ZV$=MID$(DREC$(I),42,1)
1360 IF ZV$="1" THEN 5310     SET UP FOR ACCOUNT HEADER INFO TO PRINT
1370 IF TSW=1 THEN 1400'          THB SW
1380 GOSUB 3440'             TO PRINT REPORT LINE
1390 IF SR$="SR" THEN 1140    GET NEXT DISK
1400 IF TL$="T" THEN 4770'  GO SET TAB SW
1410
1420 '****** SET UP COMPARE FIELD FOR TOTALS ******
1430
1440 IF CT$="1" THEN 4790'  FOR CTL ON CK-VCH#
1450 C1$=DAC$
1460 C2$=MID$(DAC$,1,2)
1470 C5$=MID$(DAC$,1,1)
1480 GOSUB 3260'              GO GET NEXT DISK RECORD
1490 IF CT$="1" THEN 4810     GO CHANGE COMPARE FIELD FOR CK#-VCHER#
1500 C2$=MID$(DREC$(I),2,4)
1510 C4$=MID$(DREC$(I),5,2)
1520 C6$=MID$(DREC$(I),7,1)
1530 IF C1$<C2$ THEN 4920'  GO CHECK FOR DEPP OR EQUITY ENTRY
1540 IF C1$=C2$ THEN 2060'    SEQ ERROR
1550 GOTO 1180                GO LOAD PRINT AREA
1560 T5#=T5#+T#               BUDGET TOTAL COUNTER
1570 GOTO 1510
1580 '
1590 '****** CHECK FOR SUB-CATAGORY TOTALS ******
1600 ' ****** AND LOAD PRINT AREA WITH DESCRIPTIONS ******
1610
1620 T1#=0                      CLEAR LEVEL 1 COUNTER
1630 IF ESW=1 THEN 1850         EOF SWITCH
1640 TSW=0
1650 IF C3$="1" THEN 2040
1660 IF C3$=C4$ THEN 1180
1670 IF C3$>C4$ THEN 2060'    SEQ ERROR
1680 IF C3$="11" THEN 2100
1690 IF C3$="12" THEN 2130
1700 IF C3$="13" THEN 2160
1710 IF C3$="21" THEN 2190
1720 IF C3$="22" THEN 2220
1730 IF C3$="30" THEN 2250
1740 IF C3$="41" THEN 2280
1750 IF C3$="42" THEN 2310
1760 IF C3$="43" THEN 2340
1770 IF C3$="71" THEN 2370
1780 IF C3$="72" THEN 2400
1790 IF C3$="73" THEN 2430
1800 IF C3$="74" THEN 2460
1810 IF C3$="75" THEN 2490
1820 IF C3$="76" THEN 2520
1830 IF C3$="77" THEN 2550
1840 IF C3$="78" THEN 2580
1850 CAT$="TOT INS TAX. & DEPR"
1860 NCAT$=" "
1870 GOSUB 3830'              TO LEVEL T2# PRINT ROUTINE
1880 T2#=0                      CLEAR LEVEL 2 COUNTER
1890 IF ESW=1 THEN 2010
1900 '
1910 '****** CHECK FOR MAJOR CATAGORY TOTALS ******
1920 '****** AND LOAD PRINT AREA WITH DESCRIPTION ******
1930
1940 IF C5$=C6$ THEN 1180
1950 IF C5$>C6$ THEN 2060     SEQ ERROR
1960 IF C5$="1" THEN 2610
1970 IF C5$="2" THEN 4170
1980 IF C5$="3" THEN 4520
1990 IF C5$="4" THEN 4670
2000 IF C5$="5" OR C5$="6" THEN 2080
2010 TCAT$="TOTAL EXPENSES"
2020 GOSUB 3970'          TO LEVEL T3# PRINT ROUTINE
2030 T3#=0
2040 IF ESW=1 THEN 4850'    EOF REACHED AND ESW=1
2050 GOTO 1180
2060 PRINT "SEQ ERROR":C1$;SPC(5);C2$
2070 GOTO 2070
2080 PRINT "ACCT # ERR":C1$
2090 GOTO 2090
2100 CAT$="TOTAL CURRENT ASSETS"
2110 NCAT$="FIXED ASSETS"
2120 GOTO 1870
2130 CAT$="TOTAL FIXED ASSETS"
2140 NCAT$="OTHER ASSETS"
2150 GOTO 1870
2160 CAT$="TOTAL OTHER ASSETS"
2170 NCAT$=" "
2180 GOTO 1870
2190 CAT$="TOTAL CURRENT LIAB"
2200 NCAT$="NON-CURRENT LIAB"
2210 GOTO 1870
2220 CAT$="TOT NON-CURR LIAB"
2230 NCAT$=" "
2240 GOTO 1870
2250 CAT$="TOTAL EQUITY"
2260 NCAT$=" "
2270 GOTO 1870
2280 CAT$="TOT RM/TEL.MT ROOM"
2290 NCAT$="MISC SALES"
2300 GOTO 1870
2310 CAT$="TOTAL MISC SALES"
2320 NCAT$="SALES-OTHER"
2330 GOTO 1870
2340 CAT$="TOTAL SALES OTHER"
2350 NCAT$=" "
2360 GOTO 1870
2370 CAT$="TOT COST ROOM SALES"
2380 NCAT$="COST OF TELEPHONE SERVICE"
2390 GOTO 1870
2400 CAT$="TOT COST OF TEL SER"
2410 NCAT$="COST OF OTHER SALES"
2420 GOTO 1870
2430 CAT$="TOT COST OF OTH SALE"
2440 NCAT$="GENERAL & ADMINISTRATIVE EXP"
2450 GOTO 1870
2460 CAT$="TOT GEN & ADM EXP"
2470 NCAT$="ADVERTISING & PROMOTION"
2480 GOTO 1870
2490 CAT$="TOT ADV & PROMOTION"
2500 NCAT$="REPAIRS & MAINTENANCE"
2510 GOTO 1870
2520 CAT$=" TOT REPAIRS & MAINT"
2530 NCAT$="UTILITIES"
2540 GOTO 1870
2550 CAT$="TOTAL UTILITIES"
2560 NCAT$="RESERVATION EXP"
2570 GOTO 1870
2580 CAT$="TOT RESERVATION EXP"
2590 NCAT$="INSURANCE,TAXES & DEPRECIATION"
2600 GOTO 1870
2610 TCAT$="TOTAL ASSETS"
2620 GOSUB 3970'          TO LEVEL T3# PRINT ROUTINE
2630 T3#=0
2640 IF LCT=16 THEN 2670
2650 GOSUB 2900'  TO NEW PAGE
2660 GOSUB 3160'            TO MAIN HEADING ROUTINE
2670 LPRINT "LIABILITIES" LPRINT
2680 LPRINT "CURRENT LIABILITIES"
2690 LPRINT LCT=LCT+4
2700 GOTO 2040
2710 '
2720 '****** THIS ROUTINE GETS FILE START FROM TABLE IN RECORD NUMBER ******
2730 '****** 2037.  THIS TABLE IS CREATED WHEN OUTPUTTING NEW BAL FWDS. ******
2740 '****** WHEN LISTING THE GENERAL LEDGER                          ******
2750 '
2760 GET #3,2037
2770 FOR K=1 TO 16
2780 FIELD #3, (K-1)*8 AS DD$,8 AS D2$(K)
2790 IF GD$=MID$(D2$(K),1,4) THEN 2830  'DOES DATE IN TABLE EQUAL RPT DATE
2800 NEXT K
2810 PRINT "NO FILE ADDRESS IN TABLE"
2820 GOTO 2820
2830 REC$=MID$(D2$(K),5,4)              'LOAD RECORD COUNTER WITH ADDRESS
2840 REC=VAL(REC$)
2850 GET #1,REC
2860 RETURN
2870 '
2880 '****** THIS ROUTINE SPACE TO NEW PAGE ******
2890 '
2900 FOR K=LCT TO 65
2910 LPRINT
2920 NEXT K
2930 RETURN
2940 '
2950 '****** THIS ROUTINE PRINTS PAGE SUB-HEADING AND PAGE NUMBERS ******
2960 '
2970 FOR K=1 TO 8
2980 LCT=LCT+1
2990 LPRINT
3000 NEXT K
3010 PN=PN+1
3020 LPRINT H4$;DT$;SPC(12);H5$;PN
3030 LPRINT LPRINT
3040 LPRINT H1$;SPC(22)I1$
3050 LPRINT H2$;SPC(10)I2$
3060 LPRINT H6$;H6$
3070 LPRINT
3080 LCT=LCT+7
3090 RETURN
3100 '
3110 '****** THIS ROUTINE PRINTS THE MAIN HEADINGS ******
3120 '
3130 FOR K=1 TO 8
3140 LPRINT
3150 NEXT K
3160 LPRINT H3$
3170 LPRINT
3180 LCT=2
3190 GOSUB 3010
3200 RETURN
3210 '
3220 '****** THIS ROUTINE GETS THE DISK RECORD(BLOCKED 3 PER RECORD) ******
3230 '****** AND CHECKS FOR EOF.  IT ALSO PASSES BAL FWD RECORDS WHEN ******
3240 '******* LISTING ON CHECK# AND VOUCHER #                         ******
3250 '
3260 IF IS=4 THEN 3360
3270 FOR I=IS TO 3
3280 FIELD #1, (I-1)*42 AS D$,42 AS DREC$(I)
3290 I=MID$(DREC$(I),42,1)="*" THEN 3350' SKIP BAD RECORD
3300 IF MID$(DREC$(I),1,3)="EOF" AND LSW=1 THEN 4830' TO EOF ROUTINE
3310 IF MID$(GD$,1,2)=MID$(DREC$(I),1,2) THEN 3410 ELSE 3350
3320 IF CT$="1" AND MID$(DREC$(I),42,1)="1" THEN 3350' SK BAL FWD
3330 IS=I+1
3340 RETURN
3350 NEXT I
3360 REC=REC+1
3370 IF REC=2037 THEN 3780
3380 GET #1,REC
3390 IS=1
3400 GOTO 3270
3410 IF MID$(GD$,3,2)=MID$(DREC$(I),5,2)  THEN LSW=1 GOTO 3320
3420 GOTO 3350
3430 '
3440 '****** THIS ROUTINE PRINTS A REPORT LINE AND CHECKS FOR PAGE ******
3450 '****** OVERFLOW                                               ******
3460 '
3470 LNE$=(DM0$)+(DK$)+(DDV$)+(DK$)+(DYR$)+(BL$)+(DAC$)+(BK$)+(DCV$)
3480 IF ZV$="1" THEN 3640
3490 LNE$=(LNE$)+(BK$)+(DSC$)
3500 IF LM=0 AND LT#=0 THEN 3560
3510 IF LM=0 THEN 3540
3520 LPRINT LNE$ USING E1$;L#,T#
3530 GOTO 3570
3540 LPRINT LNE$ SPC(14) USING EDT$;LT#;T#
3550 GOTO 3570
3560 LPRINT LNE$ SPC(28) USING EDT$;T#
3570 LNE$=ZB$
3580 LM=0 LT#=0
3590 LCT=LCT+1
3600 IF LCT>58 THEN 3620    'TO PAGE OVERFLOW ROUTINE
3610 RETURN
3620 GOSUB 3110
3630 GOTO 3610
3640 LNE$=(LNE$)+(DSC$)+(BK$)
3650 GOTO 3500
3660
3670  ****** THIS ROUTINE PRINTS T1# LEVEL TOTALS & CHECKS FOR ******
3680 '****** PAGE OVERFLOW                                        ******
3690
3700 IF TL$="T" AND CT$="2" THEN 3800
3710 LPRINT SPC(16); "ACCOUNT TOTAL"; SPC(6)USING EDT$;L1#,L5#,T1#
3720 L1#=0 L5#=0
3730 GOSUB 3590
3740 LPRINT
3750 GOSUB 3590
3760 RETURN
3770
3780 PRINT "DISK AREA OVERFLOW"
3790 GOTO 3790
3800 IF BL$="Y" THEN 3710
3810 GOTO 3760
3820
3830  ****** THIS ROUTINE PRINTS T2# LEVEL TOTALS & CHECKS FOR ******
3840 '****** PAGE OVERFLOW                                        ******
3850
3860 LPRINT
3870 GOSUB 3590
3880 LPRINTSPC(12);CAT$;SPC(3+(20-LEN(CAT$)))USING EDT$;L2#,L6#,T2#
3890 L2#=0 L6#=0
3900 GOSUB 3590
3910 LPRINT
3920 GOSUB 3590
3930 LPRINT NCAT$
3940 GOSUB 3590
3950 RETURN
3960 '
3970 '****** THIS ROUTINE PRINTS T3# LEVEL TOTALS & CHECKS FOR ******
3980 '****** PAGE OVERFLOW                                        ******
3990 '
4000 LPRINT
4010 GOSUB 3590
4020 LPRINTSPC(12);TCAT$;SPC(3+(20-LEN(TCAT$)))USING EDT$;L3#,L7#,T3#
4030 L3#=0 L7#=0
4040 GOSUB 3590
4050 LPRINT
4060 GOSUB 3590
4070 RETURN
4080 '
4090 '****** THIS ROUTINE PRINTS T4# LEVEL TOTALS & CHECKS FOR ******
4100 '******* PAGE OVERFLOW                                       ******
4110 '
4120 LPRINTSPC(12);TCAT$;SPC(3+(20-LEN(TCAT$)))USINGEDT$;L4#,L8#,T4#
4130 L4#=0 L8#=0
4140 GOSUB 3590
4150 RETURN
```

```
4160 '
4170 TCAT$="TOTAL LIABILITIES"
4180 GOSUB 3970
4190 LPRINT "EQUITY"
4200 GOSUB 3590
4210 GOTO 2040
4220 '
4230 '****** THIS ROUTINE GENERATES THE EQUITY ENTRY FOR THE PERIOD ******
4240 '
4250 T#=0
4260 IF CE$="Y" THEN 4280  ' ZERO CURRENT EARNINGS ON CLOSING ENTRIES
4270 T#=T#-T4#
4280 T1#=T1#-T4#
4290 T2#=T2#-T4#
4300 T3#=T3#-T4#
4310 T4#=T4#-T4#
4320 SN=SGN(T#):IF SN=-1 THEN 4460
4330 L#=T#
4340 L1#=L1#+T#
4350 L2#=L2#+T#
4360 L3#=L3#+T#
4370 L4#=L4#+T#
4380 DMO$=MID$(DT$,1,2)
4390 DDY$=MID$(DT$,4,2)
4400 DYR$=MID$(DT$,7,2)
4410 DCV$="          "
4420 DSC$="CURRENT EARNING"
4430 ZV$="2"
4440 GOSUB 3440
4450 GOTO 5330
4460 LT#=T#:LS#=L5#+T#:L6#=L6#+T#:L7#=L7#+T#:LS#=L8#+T#
4470 GOTO 4380
4480 '
4490 '****** THIS ROUTINE PRINTS THE BALANCE SHEET TOTALS AND ******
4500 '****** SETS UP FOR THE OPERATING STATEMENT              ******
4510 '
4520 TCAT$="TOT LIAB & EQUITY"
4530 GOSUB 3970
4540 T3#=0
4550 TCAT$="NET"
4560 GOSUB 4090
4570 T4#=0
4580 IF TL$="L" THEN 4600 ' LEAVE HEADING SAME AND SPACE UP
4590 H4$=H8$ ' TO CHANGE PAGE HEADING TO OPERATING  STATEMENT
4600 GOSUB 2900'  TO NEW PAGE
4610 GOSUB 3160
4620 LPRINT "INCOME" LPRINT
4630 LPRINT "ROOM-MEETING & TELEPHONE"
4640 LPRINT LCT=LCT+4
4650 GOTO 2040
4660 '
4670 TCAT$="TOTAL INCOME"
4680 GOSUB 3970
4690 "' LCT=16 THEN 4720
4700 T3#=0
4710 GOSUB 2900'  TO NEW PAGE
4720 GOSUB 3160
4730 LPRINT "EXPENSES" LPRINT
4740 LPRINT "COST OF ROOM SALES"
4750 LPRINT LCT=LCT+4
4760 GOTO 2040
4770 TSN=1
4780 GOTO 1440
4790 C1$=DCV$
4800 GOTO 1480
4810 C2$=MID$(REC$(I),11,5) ' SET UP COMPARE FIELD FOR CK#-VCHER#
4820 GOTO 1530
4830 ESW=1
4840 GOTO 5330
4850 TCAT$="PROFIT(-) OR LOSS(+)"
4860 GOSUB 4120
4870 PRINT "EOJ"
4880 LOAD "GLMENU",0,R
4890 '
4900 '****** THIS ROUTINE GENERATES THE DEPR ENTRIES FOR THE MONTH ******
4910 '
4920 IF TL$="T" AND CT$="2" THEN 5330
4930 IF DAC$="1202" THEN 5010'  GENERATE DEPRECIATION ENTRIES
4940 IF DAC$="1206" THEN 5010
4950 IF DAC$="1214" THEN 5010
4960 IF DAC$="1224" THEN 5010
4970 IF DAC$="1228" THEN 5010
4980 IF DAC$="7903" THEN 5010
4990 IF DAC$="5096" THEN 4250'  GENERATE EQUITY TRANS=TO T4#
5000 GOTO 5330
5010 FOR L=1 TO 6
5020 READ X,Y
5030 X$=STR$(X)
5040 X$=MID$(X$,2,4)
5050 IF DAC$=X$ THEN 5090
5060 NEXT L
5070 PRINT "NO PATH IN TABLE FOR ACCT#";DAC$
5080 GOTO 5080
5090 DMO$=MID$(DT$,1,2)
5100 DDY$=MID$(DT$,4,2)
5110 DYR$=MID$(DT$,7,2)
5120 DCV$="          "
5130 DSC$="DEPR MONTHLY    "
5140 ZV$="2"
5150 T#=Y
5160 IF DAC$="7903" THEN 5210
5170 L5#=L5#+T#            ADD DEPRECIATION ENTRY TO COUNTERS
5180 L6#=L6#+T#
5190 L7#=L7#+T#
5200 L8#=L8#+T#
5210 T1#=T1#+T#
5220 T2#=T2#+T#
5230 T3#=T3#+T#
5240 T4#=T4#+T#
5250 IF MID$(DAC$,1,1)<"4" THEN LT#=T#:GOTO 5280
5260 L#=T#:L1#=L1#+T#:L2#=L2#+T#:L3#=L3#+T#:L4#=L4#+T#
5270 T5#=T5#+T#
5280 RESTORE              ' RE-SET DATA POINTER IN TABLE
5290 GOSUB 3440           ' GO PRINT REPORT LINE
5300 GOTO 5330
5310 DVSC$=DCV$+(DSC$)
5320 GOTO 1370
5330 GOSUB 3670'  TO LEVEL T1# PRINT ROUTINE
5340 IF TL$="T" THEN 1620'  CAN'T TAB AND CUT NEW BAL FWDS
5350 IF BL$="Y" THEN 5390'  FOR BAL FWDS AND TO FORCE BUDGET TOTALS
5360 IF BU$="B" THEN 5390'  FOR BUDGET TOTALS ONLY
5370 GOTO 1620'       NO BAL FWDS OR BUDGET TOTALS WANTED
5380 '
5390 '****** THIS ROUTINE WRITES OUT THE NEW MONTHS BAL FWDS ******
5400 '******  AND BUDGET TOTALS                             ******
5410 '
5420 '****** SET UP TO ADD ONE (1) TO CURRENT MONTH FOR NEW  ******
5430 '******  BALANCE FORWARDS                              ******
5440 '
5450 IF ESW=1 THEN 5760
5460 IF STSW=1 THEN 6140
5470 BMO$=MID$(DT$,1,2)
5480 BMO=VAL(BMO$)
5490 BDY$="01"
5500 BYR$=MID$(DT$,7,2)
5510 BYR=VAL(BYR$)
5520 BMO=BMO+1
5530 IF BMO=13 THEN 6410'  CHANGE MO TO 01 & YR + 1
5540 BMO$=STR$(BMO)
5550 IF BMO$<"10" THEN MID$(BMO$,1,1)="0":GOTO 5600
5560 BMO$=MID$(BMO$,2,2)
5570 '
5580 '****** FIND EOF AND START WRITING NEW BAL FWDS         ******
5590 '
5600 IF SNSW<>1 THEN CLOSE 3:OPEN R$,3,GL$,DR
5610 IF CE$="Y" THEN H=1:P=1:NRSW=1:GOTO 5630
5620 H=REC:P=1'  P=LOOP START CONTROL FOR BUDGET TOTALS
5630 GET #2,H
5640 JV=IS
5650 IF JV=4 THEN 5710
5660 FOR J=JV TO 3
5670 FIELD #2, (J-1)*42 AS DB$,42 AS BREC$(J)
```

```
5680 IF WRSW=1 THEN JV=J: GOTO 6730
5690 IF MID$(BREC$(J),1,3)="EOF" THEN WRSW=1
5700 NEXT J
5710 JV=1
5720 A=A+1
5730 IF A=2037 THEN 3780
5740 GET #2,A
5750 GOTO 5660
5760 FOR J=JV TO 3
5770 IF JV=4 THEN 6150
5780 FIELD #2, (J-1)*42 AS DB$,42 AS BREC$(J)
5790 TSN=SGN(T1#)
5800 '
5810 '****** TO INSERT DECIMAL POINT AND ROUND OFF BEFORE WRITING ******
5820 '
5830 IF TSN=-1 THEN SN#=-5E-03 GOTO 5860' TO ROUND OFF -
5840 IF TSN=1 THEN SN#=5E-03 GOTO 5860' TO ROUND OFF +
5850 SN#=0
5860 T1#=T1#+SN#
5870 IF CE$="Y" AND DAC$="3096" THEN T1#=0'
5880 IF CE$="Y" AND DAC$>"3999" THEN T1#=0'
5890 IF WOSW=1 THEN BEC$="EOF": GOTO 6010
5900 DLO$=STR$(T1#): DLO$=MID$(DLO$,2,LEN(DLO$)-1)' TO DROP THE SIGN POS
5910 FOR T=1 TO LEN(DLO$)
5920 IF MID$(DLO$,T,1)="." THEN 5950' TO FIND DECEMAL POINT IF ANY
5930 NEXT T
5940 DLO$=DLO$+CENT$ GOTO 5970' NO DECEMAL, ADD .00 TO RESULT
5950 T=T+2
5960 DLO$=MID$(DLO$,1,T)' TO DROP OFF EXTRA DECEMAL POSITIONS
5970 DTL=11-LEN(DLO$)
5980 IF SGN(T1#)=-1 THEN DLO$=MID$(ZIE$,1,DTL)+DLO$ GOTO 6000
5990 DLO$=MID$(ZZE$,1,DTL)+DLO$' ADD + AND HIGH ORDER ZEROS
6000 BEC$=BMO$+(BDY$)+(BYR$)+(DAC$)+(DWSC$)+(DLO$)+NO$
6010 IF BL$<>"Y" THEN 6040  NO BAL FWDS
6020 LSET BREC$(J)=BEC$
6030 PUT #2,A
6040 FOR O=1 TO 3
6050 BREC$(O)=BZ$
6060 NEXT O
6070 JV=JV+1
6080 IF TSW=0 THEN 6240  GO WRITE NEXT MO FILE START
6090 IF BL$="Y" AND MID$(DAC$,1,1)<>"3" THEN GOSUB 6900 GOTO 6110
6100 IF BU$="B" AND MID$(DAC$,1,1)="3" THEN GOSUB 6900' TO BUDGET TOTALS
6110 IF WOSW=1 THEN 6130
6120 IF ESW=1 THEN WOSW=1 GOTO 6140
6130 GOTO 1620  NO BAL FWDS WANTED
6140 NEXT J
6150 JV=1
6160 A=A+1
6170 IF A=2037 THEN 3780
6180 GET #2,A
6190 GOTO 5760
6200
6210 '****** THIS ROUTINE WRITES NEW MO-YR AND ADDRESS IN TABLE LOCATED *****
6220 '****** IN RECORD 2037 FOR THE START OF THE NEW FILE            *****
6230 '
6240 GET #3,2037
6250 FOR K=1 TO 16
6260 FIELD #3, (K-1)*8 AS DD$,8 AS D2$(K)
6270 IF MID$(D2$(K),1,4)<"0001" THEN 6320
6280 IF MID$(D2$(K),1,2)=BMO$ THEN 6460
6290 NEXT K
6300 PRINT "OUT OF ROOM IN TABLE"
6310 GOTO 6210
6320 A$=STR$(A)
6330 IF LEN(A$)<4 THEN A$=BB$+(A$) GOTO 6330
6340 A$=MID$(A$,2,4)
6350 BU$=BMO$+(BYR$)+(A$)
6360 IF BL$<>"Y" THEN 6390  NO BAL FWDS WANTED
6370 LSET D2$(K)=BO$
6380 PUT #3,2037
6390 TSW=1
6400 GOTO 6090
6410 BMO$="01"        CHANGE MONTH TO 01
6420 BYR=BYR+1
6430 BYR$=STR$(BYR)
6440 BYR$=MID$(BYR$,2,2)
6450 GOTO 5660
6460 IF MID$(D2$(K),1,2)<BYR$ THEN 6320
6470 GOTO 6290
6480
6490 ****** THIS ROUTINE ADDS 1 TO THE DATE ENTERED TO GET THE PROPER ******
6500 ****** BAL FWD FILE WHICH WILL ALWAYS BE 1 MONTH HIGHER THAN THE ******
6510 ****** CURRENT MONTH                                            ******
6520 '
6530 GMD$=MID$(GD$,1,2)
6540 GYD$=MID$(GD$,3,2)
6550 GMD=VAL(GMD$)
6560 GYD=VAL(GYD$)
6570 GMD=GMD+1
6580 IF GMD>12 THEN GMD=1 GYD=GYD+1
6590 GMD$=STR$(GMD)
6600 IF LEN(GMD$)<3 THEN GMD$="0"+MID$(GMD$,2,2) GOTO 6620
6610 GMD$=MID$(GMD$,2,2)
6620 GYD$=STR$(GYD) GYD$=MID$(GYD$,2,2)
6630 GD$=GMD$+GYD$
6640 H4F=HC$  TO CHANGE PAGE HEADING TO BALANCE SHEET
6650 GOTO 1110
6660
6670 ****** THIS ROUTINE CONVERTS THE OUTPUT FILES 2,3 & 4 TO A ******
6680 ****** NEW DISK MOUNTED ON DR 0 WHEN IT IS DETERMINED THAT ******
6690 ****** THE AREA ON DR1 MAY NOT HOLD A COMPLETE MONTHS FILE ****
6700 ****** WHEN THIS OCCURS. ALL OUTPUT WILL BE TO DR 0. THIS RUN ***
6710 ****** ONLY                                                  *****
6720
6730 FR2=2037-A
6740 IF FR2<350 THEN 6760  ' MY MAXIMUM FILE SIZE =350*3
6750 GOTO 5760
6760 I=1 JV=1
6770 CLOSE 2,3,4
6780 UNLOAD 0
6790 DR=0
6800 PRINT "OUT OF DISK SPACE ON DR# 1"
6810 PRINT "PUT NEW INITIALIZED DISK ON DR# 0"
6820 INPUT "ENTER -C- TO CONTINUE";OT$
6830 IF OT$<>"C" THEN 6820
6840 MOUNT 0
6850 OPEN R#,2,GL$,DR
6860 OPEN R#,3,GL$,DR
6870 OPEN "O",4,"BUDGET",DR
6880 GOTO 5760
6890
6900 ****** THIS ROUTINE WRITES OUT THE BUDGET FIGURES FOR THE ******
6910 ****** CURRENT MONTH ON THE END OF THE DISK                 ******
6920 '
6930 IF WOSW=1 THEN 7150  GO CLOSE BUDGET FILE
6940 TSN=SGN(T5#)
6950 IF TSN=-1 THEN SN#=-5E-03 GOTO 6980' TO ROUND OFF -
6960 IF TSN=1 THEN SN#=5E-03 GOTO 6980'  TO ROUND OFF +
6970 SN#=0                               TO ROUND OFF 0
6980 T5#=T5#+SN#
6990 DLO$=STR$(T5#) DLO$=MID$(DLO$,2,LEN(DLO$))  TO DROP THE SIGN POS
7000 FOR T=1 TO LEN(DLO$)
7010 IF MID$(DLO$,T,1)="." THEN 7040' TO FIND THE DECEMAL POINT IF ANY
7020 NEXT T
7030 DLO$=DLO$+CENT$ GOTO 7060  NO DECEMAL ADD .00 TOO RESULTS
7040 T=T+2
7050 DLO$=MID$(DLO$,1,T)  TO DROP OFF EXTRA DECEMAL POSITIONS
7060 DTL=11-LEN(DLO$)
7070 IF SGN(T5#)=-1 THEN DLO$=MID$(ZIE$,1,DTL)+DLO$ GOTO 7090
7080 DLO$=MID$(ZZE$,1,DTL)+DLO$'  ADD + AND HIGH ORDER ZEROS
7090 BG$=BG$+BMO$+BDY$+BYR$+DAC$+DWSC$+DLO$+NO$
7100 T5#=0
7110 P=P+1
7120 IF P=4 THEN 7140
7130 RETURN
7140 P=1
7150 PRINT #4,BG$
7160 IF WOSW=1 THEN 7190' GO CLOSE BUDGET FILE
7170 BG$=ZBG$
7180 GOTO 7130
7190 CLOSE 4
7200 GOTO 7150
7210 LT#=LT#+T#              ' CREDIT COUNTERS
```

```
7220 LS#=LS#+T#
7230 L6#=L6#+T#
7240 L7#=L7#+T#
7250 L8#=L8#+1#
7260 GOTO 1300
7270 L#=L#+T#                    DEBIT COUNTERS
7280 L1#=L1#+T#
7290 L2#=L2#+1#
7300 L3#=L3#+T#
7310 L4#=L4#+1#
7320 GOTO 1300
7330 END
```

Figure 25. GL2 Program Listing

Program GL3

This program is used to update the Bank Reconciliation File for Account 1110 (the general checking account). It merges the balance forward, checks and vouchers for Account 1110 in this month's ledger file with the checks outstanding in last month's BANKCURR (this month's BANKBKUP file) and produces this month's BANKCURR file. The result of the merge is a file called BANKCURR which contains this month's transactions to Account 1110 and last month's outstanding checks. One caution — before running this program, copy BANKCURR to BANKBKUP or you will be merging the wrong data and destroying the data you should have been merging. The program cautions you before running it.

```
10 ' PROGRAM NAME "GL3"
20 ' PROGRAMMED BY:     BUD SHAMBURGER      NOVEMBER 1976
30 '
40 '
50 '
60 '
70 ' UPDATES CURRENT MONTHS BANK-BALANCE TRANSACTION FILE FOR BALANCING
80 ' THE GENERAL CHECKING ACCOUNT TO THE BANK STATEMENT(FOR LEDGER ACCOUNT
90 ' 1110)
100 '
110 ' THIS PROGRAM MERGES LAST MONTHS OUTSTANDING CHECK FILE "BANKBKUP"
120 ' ON DR1, 1-200 WITH THIS MONTHS GENERAL "LEDGER" TRANSACTIONS AND
130 ' BAL FWD FOR ACCT# 1110 ON DR0 TO PRODUCE THIS MONTHS "BANKCURR"
140 ' FILE ON DR1, 201-400.  IT DELETES ALL ITEMS FROM "BANKBKUP"
150 ' EXCEPT ITEMS WITH "2" IN COL 42.   THE MERGE IS DONE ON CK#/VCH#
160 '
170 '*****************************************************************
180 '
190 CLEAR 1500
200 JS=4
210 KS=4
220 A3=200
230 INPUT "ENTER -Y- TO MOUNT THE FILES";WY$
240 IF WY$<>"Y" THEN 270
250 UNLOAD 0,1
260 MOUNT 0,1
270 OPEN "R",1,"LEDGER",0
280 OPEN "R",2,"BANKBKUP",1
290 OPEN "R",3,"BANKCURR",1
300 PRINT "* BEFORE RUNNING THIS PROGRAM - COPY BANKCURR TO BANKBKUP * "
310 PRINT "MERGE -LEDGER-DR0 AND -BANKBKUP-DR1 AND CUT NEW -BANKCURR-DR1"
320 INPUT "ENTER REPORT DATE AS MOYR";DT$
330 GOSUB 530'                  GO GET LEDGER FILE START FROM 2037
340 GOSUB 680'                  GO GET 1ST LEDGER RECORD FROM FILE
350 GOSUB 880'                  GO GET 1ST BANKBKUP RECORD FROM FILE
360 IF C1$<C2$ THEN 450
370 IF C1$=C2$ THEN PRINT "DUPLICATE CTL#";C1$,C2$:STOP
380 IF KEF=1 AND JEF=1 THEN 1220'  GO WRITE LAST BANKCURR & EOF
390 DUM$=K2$(K)'                 MOVE BANKBKUP TO OUTPUT AREA
400 GOSUB 1080'                   GO CHECK FOR PUT TO BANKCURR
410 IF KEF=1 THEN 450'                ALL OF BANKBKUP MERGED IN
420 GOSUB 880'                   GO GET NEXT BANKBKUP RECORD FROMFILE
430 IF JEF=1 THEN 380'                ALL OF LEDGER MERGED IN
440 GOTO 360
450 IF KEF=1 AND JEF=1 THEN 1220'  GO WRITE LAST BANKCURR & EOF
460 DUM$=J1$(J)'                 MOVE LEDGER TO OUTPUT AREA
470 GOSUB 1080'                   GO CHECK FOR PUT TO BANKCURR
480 IF JEF=1 THEN 380'                ALL OF LEDGER MERGED IN
490 GOSUB 680'                   GO GET NEXT LEDGER RECORD FROM FILE
500 IF KEF=1 THEN 450'                ALL OF BANKBKUP MERGED IN
510 GOTO 360
520 '
530 ' THIS ROUTINE GETS THE LEDGER FILE START FROM 2037 AND PUTS IT
540 ' IN A1
550 '
560 GET #1,2037
570 FOR I=1 TO 16
580 FIELD #1, (I-1)*8 AS D$,8 AS DD$(I)
590 IF DT$=MID$(DD$(I),1,4) THEN 620
600 NEXT I
610 PRINT "FILE START NOT IN TABLE":STOP
620 A1$=MID$(DD$(I),5,4)
630 A1=VAL(A1$)
640 RETURN
650 '
660 ' THIS ROUTINE GETS THE PROPER LEDGER RECORD
670 '
680 IF JS=4 THEN 830
690 FOR J=JS TO 3
700 FIELD #1, (J-1)*42 AS J$,42 AS J1$(J)
710 IF MID$(J1$(J),1,3)="EOF" AND JW=1 THEN JEF=1:GOTO 380' EOF LEDGER
720 DT$=MID$(J1$(J),1,2)+MID$(J1$(J),5,2)
730 IF DT$<>DT$ THEN 810'          NOT CURRENT FILE YET
740 JW=1                           START OF CURRENT FILE
750 IF MID$(J1$(J),7,4)<>"1110" THEN 810'    NOT BANK RECORD
760 IF MID$(J1$(J),41,1)="*" THEN 810'     BYPASS BAD RECORD
770 IF MID$(J1$(J),42,1)="1" THEN JS=J+1 DUM$=J1$(J):GOTO 350
780 C1$=MID$(J1$(J),11,5)
790 JS=J+1                         THIS IS THE PROPER RECORD
800 RETURN
810 NEXT J
820 IF A1=2037 THEN PRINT "FILEND ERROR-LEDGER":STOP
830 GET #1,A1
840 JS=1
850 A1=A1+1
860 GOTO 680
870 '
880 ' THIS ROUTINE GETS THE PROPER BANKBKUP RECORD FROM THE FILE
890 ' LOCATE DR1, 1-200
900 '
910 IF KS=4 THEN 1020
920 FOR K=KS TO 3
930 FIELD #2, (K-1)*42 AS K$,42 AS K2$(K)
940 IF MID$(K2$(K),1,3)="EOF" THEN KEF=1 GOTO 450' END OF BANKBKUP
950 IF MID$(K2$(K),42,1)<>"2" THEN 1010' DELETE THESE RECORDS FROM FILE
960 IF MID$(K2$(K),11,1)="V" THEN 1010' DELETE VOUCHERS FROM FILE
970 IF MID$(K2$(K),16,4)="VOID" THEN 1010' DELETE VOID CKS FROM FILE
980 C2$=MID$(K2$(K),11,5)
990 KS=K+1                         THIS IS THE PROPER RECORD
1000 RETURN
1010 NEXT K
1020 A1=A2+1
```

```
1030 IF A2=201 THEN PRINT "FILEND ERROR-BANKUP" STOP
1040 GET #2,A2
1050 K$=1
1060 GOTO 910
1070
1080   THIS ROUTINE WRITES OUT THE BANKCURR FILE IN 201-400#R1
1090
1100 FIELD #1 128 AS L4$
1110 L3$=L3$+DUM$
1120 L=L+1
1130 IF L=2 THEN 1150
1140 RETURN
1150 A2=A2+1
1160 IF A2>400 THEN PRINT "FILEND ERR BANKCURR" STOP
1170 LSET L4$=L3$
1180 PUT #2 A2
1190 L3$=BLK$
1200 L=0
1210 GOTO 1140
1220 L3$=L3$+"EOF"       LOAD END OF FILE TRAILER RECORD
1230 LSET L4$=L3$
1240 A2=A2+1
1250 IF A2>400 THEN 1160
1260 PUT #2 A2           WRITE OUT END OF FILE TRAILER RECORD
1270 CLOSE
1280 PRINT "EOJ"
1290 LOAD "GLMENU",0,R
1300 END
```

Figure 26. GL3 Program Listing

Program GL4

This program tags the check transactions contained in BANKCURR after the merge above, and changes their type code from a 2 to a 3 indicating they have cleared the bank (cashed). When entering the data for this program, the cancelled checks are the source document. Enter the check number and get the check amount from the MICR (magnetic ink field) amount in the lower right hand corner of the check coded by the bank. This will assure you that the bank cleared the check for the same amount you have entered in your ledger. The program compares both the check number and the amount entered to the same data in your BANKCURR file. You may have even entered it yourself wrongly and the bank may be correct. Anyway, it gives you a double check and that's what accounting is all about. Now the cancelled checks do not have to be in numerical order. I enter them just as they come out of the bank envelope. The program contains its own sort routine to sort the checks to match them to the BANKCURR file. Any unmatched items are printed on the terminal and tagged as cashed anyway. My experience has been that I enter it wrongly on the terminal more often than the bank makes an error. Doublecheck all errors on the terminal to be sure who is right.

```
10 ' PROGRAM NAME "GL4"
20 ' PROGRAMMED BY     BUD SHAMBURGER        NOVEMBER 1976
30 '
40 '
50 '
60 '
70 ' THIS PROGRAM TAKES THE DATA ENTERED FROM THE TERMINAL,
80 ' (CHECK NUMBER AND MONEY AMOUNT FROM ENCODED MICR BANK FIELD)
90 ' (TAKEN FROM THIS MONTHS CANCELLED CHECKS)
100 ' (CHANGES THE RECORD TYPE CODE TO A '3' ON THE DISK RECORD)
110 ' SORTS IT ON CK# AND TAGS THE -BANKCURR- FILE FOR CHECKS CASHED,
120 ' COMPARING ON CHECK NUMBER AND MONEY AMOUNT.
130 ' -BANKCURR- FILE IS ON DR1  500 ENTRIES MAX FROM TERMINAL
140 '
150 '*************************************************     ***********
160 '
170 CLEAR 1000
180 PRINT "TAG CHECKS CASHED - 500 ENTRIES MAX"
190 DIM B(500)
200 DIM BB$(500)
210 JS=4
220 REC=200
230 INPUT "ENTER -Y- TO MOUNT THE FILE";WY$
240 IF WY$<>"Y" THEN 280
250 UNLOAD 1:MOUNT 1
260 PRINT "** ENTER ** -T- TO TERMINATE INPUT"
270 PRINT
280 INPUT "ENTER REPORT DATE AS MOYR";DT$
290 H1$="  CHEK    AMOUNT"
300 H2$="  NMBR $$$.$$$.$$"
310 PRINT H1$:PRINT H2$
320 FOR J=1 TO 2
330 INPUT A$
340 IF MID$(A$,1,1)="T" THEN 520'    LAST ENTRY MADE - GO SORT ON CHECK#
350 B=LEN(A$)
360 IF B<>15 THEN 490
370 IF MID$(A$,5,1)<>" " THEN 490         'EDIT
380 IF MID$(A$,9,1)<>" " AND MID$(A$,9,1)<>" " THEN 490' EDIT
390 IF MID$(A$,13,1)<>" " THEN 490
400 I=I+1
410 C$=MID$(A$,1,4)
420 C=VAL(C$)
430 B(I)=C
440 D$="-"+MID$(A$,6,3)+MID$(A$,10,6)
450 BB$(I)=D$
460 NEXT J
470 IF I>500 THEN PRINT "TOO MANY ENTRIES":STOP
480 GOTO 290
490 PRINT CHR$(7);CHR$(7);CHR$(7);CHR$(7);CHR$(7);CHR$(7)
500 PRINT H1$:PRINT H2$'    EDIT ERROR REPEAT LINE
510 GOTO 330
520 N=I
530 GOSUB 1020'              GO SORT ON CHECK#
540 OPEN "R",1,"BANKCURR",1
550 GOSUB 770'               GO GET 1ST DISK RECORD
560 FOR I=1 TO N
570 DCK=VAL(DCK$)
580 IF B(I)=DCK THEN 620'  GO CHECK AMOUNT & TAG
590 IF B(I)<DCK THEN 740'  NOT IN DISK FILE ERROR
600 GOSUB 770'               GO GET NEXT DISK RECORD
610 GOTO 570
620 IF BB$(I)=DOL$ THEN 650
630 PRINT "AMOUNT UNEQUAL ",B(I),BB$(I),DOL$
640 PRINT "TAGGED ANYWAY"
650 DSK$=DREC$(J)
660 MID$(DSK$,27,4)=DT$
670 MID$(DSK$,42,1)="3"
680 LSET DREC$(J)=DSK$
690 PUT #1,REC
700 NEXT I
710 CLOSE
720 PRINT "EOJ"
730 LOAD "GLMENU",0,R
740 PRINT "NOT IN DISK FILE";B(I)
750 GOTO 700
760 '
770 ' THIS ROUTINE GETS THE DISK RECORD
780 '
790 IF JS=4 THEN 900
800 FOR J=JS TO 3
810 FIELD #1, (J-1)*42 AS D$,42 AS DREC$(J)
820 IF MID$(DREC$(J),1,3)="EOF" THEN 950'   END OF DISK FILE
830 IF MID$(DREC$(J),42,1)<>"2" THEN 890'   BYPASS BAL FWD & BAD RECORDS
840 IF MID$(DREC$(J),11,1)<>"C" THEN 890'   BYPASS VOUCHERS
850 DCK$=MID$(DREC$(J),12,4)
860 DOL$=MID$(DREC$(J),31,1)+MID$(DREC$(J),33,9)
870 JS=J+1
880 RETURN
890 NEXT J
900 REC=REC+1
910 IF REC>400 THEN 950
920 GET #1,REC
930 JS=1
940 GOTO 790
950 IF I>N THEN 710
960 P=I
970 FOR I=P TO N
980 PRINT "NO DISK RECORD FOR ";B(I)
990 NEXT I
1000 GOTO 710
1010 '
1020 ' THIS ROUTINE SORTS THE TERMINAL ENTRIES ON CHECK#
1030 '
1040 M=N
1050 M=INT(M/2)
1060 EXH=0
1070 IF M=0 THEN 1210  ' END OF SORT - GOTO NEXT ROUTINE
1080 K=N-M
1090 Q=1
1100 I=Q
1110 L=I+M
1120 IF B(I)<=B(L) THEN 1180
1130 SWAP B(I),B(L)
1140 SWAP BB$(I),BB$(L)
1150 EXH=EXH+1
1160 I=I-M
1170 IF I>=1 THEN 1110
1180 Q=Q+1
1190 IF Q>K THEN PRINT "M = ";M;" SWAPS MADE = ";EXH:GOTO 1050
1200 GOTO 1100
1210 RETURN'       END OF SORT
1220 END
```

Figure 26a. GL4 Program Listing

Program GL5

This program lists the BANKCURR file in a bank reconciliation format. This listing is used to verify that the ledger account 1110 is in balance with the bank statement.

```
10 ' PROGRAM NAME "GL5"
20 ' PROGRAMMED BY     BUD SHAMBURGER       NOVEMBER 1976
30 '
40 '
50 '
60 '
70 ' THIS PROGRAM LIST "BANKCURR" FILE FOR ACCOUNT #1110 AND PRINTS
80 ' OUT BAL FWDS, CHECKS CASHED, CHECKS WRITTEN, CHECKS OUTSTANDING,
90 ' DEPOSITS, ADJUSTMENTS AND NEW BANK BALANCE.  THE FILE IS ON DR1
100 ' "BANKCURR" IS A RANDOM FILE RESIDING IN RECORDS 201-400.
110 ' THE RECORD LAYOUT IS THE SAME AS THE GENERAL LEDGER(BLOCKED 3
120 ' PER SECTOR)
130 '
140 '*************************************************************
150 '
160 CLEAR 1500
170 E2DT$="###,###.##-          ###,###.##-          ###,###.##-"
180 INPUT "ENTER -Y- TO MOUNT THE FILE";WY$
190 IF WY$<>"Y" THEN 210
200 UNLOAD 1 MOUNT 1
210 OPEN "R",1,"BANKCURR",1
220 IS=4:B$=" ":BK$="          "
230 REC=200    'FILE START
240 EDT$="###,###.##-"   ' EDIT WORD FOR LINE PRINTER
250 E1DT$="          ###,###.##-###,###.##-          ###,###.##-" 'EDIT WD
260 '
270 ' PAGE HEADINGS
280 '
290 H1$="CONWAY R.I.  INC ,  CONWAY, ARK"
300 H2$="BANK RECONCILLIATION - GENERAL ACCOUNT - PERIOD ENDING "
310 H3$="PAGE "
320 H5$="CHECKS    CKSCASHED   CKSWRIT/  DEPOSIT/    LEDGER"
330 H6$="VNUMB MO DY DESCRIPTION    "
340 H4$="CNUMB"
350 H7$="OUTSTAND   CHARGES    CHARGES   CREDITS     BALANCE"
360 '
370 PRINT "BANK RECONCILLIATION, ACCOUNT# 1110"
380 INPUT "ENTER PERIOD ENDING DATE AS MO-DY-YR";DT$
390 RMO$=MID$(DT$,1,2)
400 INPUT "ENTER BANKS BEGINNING BALANCE AS -XXXXX.XX";BL#
410 T6#=BL#                 'EOJ TOTAL ROUTINE COUNTER
420 GOSUB 1260               'GO PRINT HEADINGS
430 GOSUB 1100               'GO GET DISK RECORD
440 DCV$=MID$(DREC$(I),11,5)  ' LOAD WORK AREAS
450 DMO$=MID$(DREC$(I),1,2)
460 DYD$=MID$(DREC$(I),3,2)
470 DIS$=MID$(DREC$(I),16,11)
480 DOL$=MID$(DREC$(I),31,11)
490 DOL#=VAL(DOL$)
500 DDC$=MID$(DREC$(I),42,1)
510 IF DMO$=RMO$ THEN 630 ' DOES DISK MONTH = REPORT MONTH
520 '
530 ' IS IT AN UNCASHED CHECK
540 '
550 IF DDC$="2"ANDMID$(DCV$,1,1)="C"THENL1#=DOL#:T1#=T1#+DOL#:GOTO880
560 '
570 ' IS IT A CASHED CHECK
580 '
590 IF DDC$="3"ANDMID$(DCV$,1,1)="C"THENL2#=DOL#:T2#=T2#+DOL#:GOTO910
600 PRINT "DISK TYPE CODE ERR":STOP
610 GOSUB 1370               'GO CHECK FOR PAGE OVERFLOW
620 GOTO 430                 'NEXT LINE & RECORD
630 L5#=DOL#       ' DOLLAR AMOUNT FROM DISK
640 T5#=T5#+DOL#   ' LEDGER BALANCE LINE TOTAL
650 IF DDC$="1" THEN 860   ' IS IT A BALANCE FORWARD DISK RECORD
660 IF MID$(DCV$,1,1)="V" THEN 760  ' IS IT A DISK VOUCHER TRANSACTION
670 L3#=DOL#:T3#=T3#+DOL# ' CHECKS WRITTEN COUNTERS
680 IF DDC$="2" AND MID$(DCV$,1,1)="C" THEN 710 ' IS IT UNCASHED CHECK
690 IF DDC$="3" AND MID$(DCV$,1,1)="C" THEN 740 ' IS IT CASHED CHECK
700 GOTO 600
710 L1#=DOL#:T1#=T1#+DOL# ' CHECKS OUTSTANDING COUNTERS
720 IF MID$(DIS$,1,4)="VOID" THEN 1060 ' IS IT A VOID CHECK OR VOUCHER
```

```
730 GOTO 940
740 L2#=DOL#: T2#=T2#+DOL# ' CHECKS CASHED COUNTERS
750 GOTO 970
760 SN=SGN(DOL#)
770 '
780 ' IS IT A CREDIT OR DEBIT TRANSACTION
790 '
800 IF SN=-1THENL3#=DOL#: T3#=T3#+DOL#: L2#=DOL#: T2#=T2#+DOL#: GOTO1030
810 L4#=DOL#: T4#=T4#+DOL#
820 GOTO 1000
830 '
840 ' PRINT THE TYPE OF REPORT LINE DESIRED
850 '
860 LPRINT SPC(6);DMO$;B$;DYD$;B$;DCV$;DIS$;SPC(40)USINGEDT$;L5#
870 GOTO 610
880 LN$=DCV$+B$+DMO$+B$+DYD$+B$+DIS$+B$
890 LPRINT LN$ USING EDT$;L1#
900 GOTO 610
910 LN$=DCV$+B$+DMO$+B$+DYD$+B$+DIS$+B$
920 LPRINT LN$ SPC(11) USING EDT$;L2#
930 GOTO 610
940 LN$=DCV$+B$+DMO$+B$+DYD$+B$+DIS$+B$
950 LPRINT LN$ USING E2DT$;L1#,L3#,L5#
960 GOTO 610
970 LN$=DCV$+B$+DMO$+B$+DYD$+B$+DIS$+B$
980 LPRINT LN$ USING E1DT$;L2#,L3#,L5#
990 GOTO 610
1000 LN$=DCV$+B$+DMO$+B$+DYD$+B$+DIS$+B$
1010 LPRINT LN$ SPC(33) USING EDT$;L4#,L5#
1020 GOTO 610
1030 LN$=DCV$+B$+DMO$+B$+DYD$+B$+DIS$+B$
1040 LPRINT LN$ USING E1DT$;L2#,L3#,L5#
1050 GOTO 610
1060 LN$=DCV$+B$+DMO$+B$+DYD$+B$+DIS$+B$
1070 LPRINT LN$
1080 GOTO 610
1090 '
1100 ' THIS ROUTINE GETS THE DISK RECORD FROM "BANKCURR" LOCATED
1110 ' ON DR1, RECORD 201-400
1120 '
1130 IF I5=4 THEN 1210
1140 FOR I=I5 TO 3
1150 FIELD #1, (I-1)*42 AS D$,42 AS DREC$(I)
1160 IF MID$(DREC$(I),1,3)="EOF" THEN 1500  'TO EOJ ROUTINE
1170 IF MID$(DREC$(I),42,1)="*" THEN 1200
1180 I5=I+1
1190 RETURN
1200 NEXT I
1210 REC=REC+1: IF REC>400 THEN PRINT "FILEND ERR": STOP
1220 GET #1,REC
1230 I5=1
1240 GOTO 1130
1250 '
1260 ' THIS ROUTINE PRINTS THE PAGE HEADINGS AND RESETS
1270 ' THE LINE COUNTER
1280 '
1290 LPRINT SPC(3);H1$:LPRINT
1300 PAG=PAG+1
1310 LPRINT H2$;DT$;SPC(2);H3$;PAG:LPRINT
1320 LPRINT H4$;SPC(22);H5$
1330 LPRINT H6$;B$;H7$:LPRINT
1340 LC=8
1350 RETURN
1360 '
1370 ' THIS ROUTINE CHECKS FOR PAGE OVERFLOW
1380 '
1390 LC=LC+1
1400 IF LC>57 THEN 1420
1410 RETURN
1420 FOR J=LC TO 66
1430 LPRINT
1440 NEXT J
1450 GOSUB 1260
1460 GOTO 1410
1470 '
1480 ' EOJ TOTAL ROUTINE
1490 '
1500 LPRINT:GOSUB 1370
1510 LPRINT SPC(5)"TOTALS"SPC(13) USINGEDT$;T1#,T2#,T3#,T4#,T5#
1520 LPRINT
1530 LPRINT "BEG BANK BALANCE " USING EDT$;T6#:T6#=T6#+T2#
1540 LPRINT "CKSCASHED/CHARGES" USING EDT$;T2#:T6#=T6#+T4#
1550 LPRINT "DEPOSITS/CREDITS " USING EDT$;T4#
1560 LPRINT "-------------------------------"
1570 LPRINT "END BANK BALANCE " USING EDT$;T6#:LPRINT
1580 LPRINT "CHECKS OUTSTAND  " USING EDT$;T1#:T6#=T6#+T1#
1590 LPRINT "-------------------------------"
1600 LPRINT "BALANCE          " USING EDT$;T6#
1610 LPRINT "LEDGER BALANCE   " USING EDT$;T5#
1620 LPRINT "-------------------------------"
1630 T7#=T6#-T5#
1640 LPRINT "DEPOSITS IN TRANS"
1650 LPRINT "LAST MONTH       " USING EDT$;T7#
1660 PRINT "EOJ"
1670 LOAD "GLMENU",0,R
1680 END
```

Figure 27. GL5 Program Listing

Program GL6

This program is the special purpose program which enters the special journal vouchers. Since I have a stack of them every month this program was developed to take the drudgery out of entering this pile of data and increase the accuracy of the data.

```
10   PROGRAM NAME "GL6"
20 ' PROGRAMMED BY     BUD SHAMBURGER        NOVEMBER 1976
30 '
40 '
50 '
60 '
70 ' A PROGRAM TO ENTER AND EDIT GENERAL LEDGER DAILY DEPOSIT
80 ' VOUCHERS FROM THE TERMINAL AND OUTPUT THEM TO DISK OR 1.
90 ' A SPECIAL PROGRAM UNIQUE TO CONWAY R.I.'S DAILY TRANSACTIONS.
100 ' IT GENERATES A FIXED SET OF LEDGER TRANSACTIONS, ASSIGNS THE
110 ' ACCOUNT NUMBERS, THE JOURNAL VOUCHER NUMBERS(BASED ON THE DATE)
120 ' SUPPLIES THE PROPER DESCRIPTION, DETERMINES WHICH ONES ARE
130 ' DEBITS AND CREDITS AND MAKES CERTAIN THAT THE
140 ' DEBITS AND CREDITS ARE EQUAL.  IT ALSO PRINTS A HARD COPY
150 ' OF THE TRANSACTIONS ON THE LINE PRINTER
160 ' THE OPERATOR SUPPLIES ONLY THE DEBIT OR CREDIT MONEY AMT.
170 '
180 ********************************************************************
190
200 CLEAR 1500
210 INPUT "ENTER -Y- TO MOUNT THE FILE";WY$
220 IF WY$<>"Y" THEN 240
230 UNLOAD 1: MOUNT 1
240 DIM B$(100)     ' MATRIX FOR DATA FROM THE TERMINAL
250 DIM I1(16)   ' SUBSCRIPT FOR TABLE IN RECORD 2037
260 R$="R": F=1: D=1: BK$=" ": ZER$="0000000"
270 GL$="LEDGER"
280 TY$="2"
290 PRINT "GENERAL LEDGER TRANSACTIONS"
300 PRINT
310 PRINT "DAILY DEPOSIT VOUCHERS"
320 INPUT "ENTER TRANSACTION MO-DY-YR";DT$
330 GD$=MID$(DT$,1,2)+MID$(DT$,7,2)   ' EXTRACT DATE FOR TABLE COMPARE
340 VDY$=MID$(DT$,4,2)          'EXTRACT DATE FOR ASSIGNING JNL VCHR #
350 VDY=VAL(VDY$)
360 MO$=MID$(DT$,1,2)+MID$(DT$,4,2):MO=VAL(MO$)
370 PRINT "ENTER -N- FOR NO TRANSACTION"
380 PRINT "ENTER -DONE- TO STOP"
390 OPEN R$,F,GL$,D          ' OPEN THE LEDGER FILE
400 A=2037                   ' ADDRESS OF FILE TABLE
410 GET #1,A                 ' GET TABLE
420 FOR I1=1 TO 16
430 FIELD #1, (I1-1)*8 AS D$, 8 AS D1$(I1)
440 IF GD$=MID$(D1$(I1),1,4) THEN 480 ' IS THIS THE PROPER MO AND YEAR ENTRY
450 NEXT I1                  ' GET NEXT TABLE ENTRY
460 PRINT "NO FILE ADDRESS IN TABLE"
470 STOP
480 REC$=MID$(D1$(I1),5,4)
490 REC=VAL(REC$)    ' LOAD THE ADDRESS FOR THIS DATES FILE START
500 GET #1,REC       ' GET THE THE RECORD
510 IF VDY>31 THEN 1100      ' END OF THIS MONTHS VOUCHERS
520 '
530 ' ROUTINE FOR PROCESSING THE 16 LINES OF DATA FROM THE TERMINAL
540 '
550 FOR I=1 TO 16
560 PRINT "   TRANS ACCT VOCHR                          AMOUNT" 'TERMINAL HEADING
570 PRINT "  MODYYR NMBR NUMBR DESCRIPTION      $$$$$$.$$"
580 NUM$=STR$(MO)+NUM$="V"+NUM$ IF MID$(NUM$,2,1)<"1" THEN
    MID$(NUM$,2,1)="0"          ' CONSTRUCT VOUCHER NUMBER
590
600   ASSIGN THE JOURNAL ACCOUNT NUMBER AND DESCRIPTION
610 '
620 IF I=1 THEN ACC$="1110": DS$="BANK DEPOSIT     ":GOTO 820
630 IF I=2 THEN ACC$="1130": DS$="ACCTS REC        ": GOTO 820
640 IF I=3 THEN ACC$="1129": DS$="CITY LEDGER      ": GOTO 820
650 IF I=4 THEN ACC$="7400": DS$="CR CARD DISC     ": GOTO 820
660 IF I=5 THEN ACC$="7404": DS$="SHORT            ": GOTO 820
670 '
680   IF ITS A CREDIT ACCOUNT - TURN ON SWITCH 1
690 '
700 IF I=6 THEN ACC$="4100": DS$="ROOM RENT       -": SW=1: GOTO 820
710 IF I=7 THEN ACC$="4204": DS$="SALES TAX       -": SW=1: GOTO 820
720 IF I=8 THEN ACC$="4102": DS$="TELEPHONE       -": SW=1: GOTO 820
730 IF I=9 THEN ACC$="2134": DS$="DUE BOWENS      -": SW=1: GOTO 920
740 IF I=10 THEN ACC$="4302": DS$="NEWSSTAND      -": SW=1: GOTO 820
750 IF I=11 THEN ACC$="4101": DS$="MEETING ROOM   -": SW=1: GOTO 820
760 IF I=12 THEN ACC$="1130": DS$="ACCTS REC      -": SW=1: GOTO 820
770 IF I=13 THEN ACC$="1129": DS$="CITY LEDGER    -": SW=1: GOTO 820
780 IF I=14 THEN ACC$="1129": DS$="CR CARD DISC   -": SW=1: GOTO 820
790 IF I=15 THEN ACC$="4301": DS$="VALET          -": SW=1: GOTO 820
800 ACC$="7404" DS$="LONG          -": SW=1
810 '
820 A$=MID$(NUM$,2,4)+MID$(DT$,7,2)
    +BK$+ACC$+BK$+NUM$+BK$+DS$       ' CONSTRUCT TERMINAL LINE
830 PRINT "  ";A$      ' PRINT TERMINAL LINE
840 INPUT "                                    ";AA$ ' INPUT TER LINE
850 IF MID$(AA$,1,1)="N" THEN SW=0:GOTO 940 ' IS IT A NO TRANSACTION
860 IF MID$(AA$,1,4)="DONE" THEN 1190  ' IS IT END OF LAST VOUCHER
870 LT=LEN(AA$)
880 AB$=AA$
890 AA$=MID$(ZER$,1,10-LT)+AB$ ' ADD HIGH ORDER ZEROS TO MONEY FIELD
900 IF MID$(AA$,8,1)<>"." THEN 1240 ' EDIT THE MONEY FIELD
910 TT#=VAL(AA$)          ' COUNTER TO ZERO THE DEBITS AND CREDITS
920 IF SW=1 THEN T#=T#-TT#: SW=0: GOTO 940 ' IS IT A CREDIT-TURN OFF SW1
930 T#=T#+TT#             ' ITS A DEBIT
940 A$=A$+AA$
950 LPRINT A$; SPC(5) USING "##"; I ' PRINT HARD COPY AUDIT LIST
960 B$(I)=MID$(A$,1,6)+MID$(A$,8,4)+MID$(A$,13,5)+MID$(A$,19,16)
970 B$(I)=B$(I)+MID$(A$,35,10)+TY$     ' LOAD THE MATRIX WITH TRANSACTION
980 NEXT I                ' GO PROCESS NEXT TRANSACTION
990 B$(17)="T"            ' LOAD STOP CODE IN MATRIX
1000 PRINT SPC(32) USING "$#,###,###.##-"; T# ' PRINT SUM OF DEBITS & CREDITS
1010 LPRINT SPC(30) USING "$#,###,###.##-"; T#
1020 LPRINT
1030 B$(I)="T"
1040 IF T#<.01# AND T#>-.01# THEN IF T#<>0# THEN 1120' DR=CR GO PUT DISK
1050 PRINT "** ERROR ** DR<>CR - RE-ENTER VOUCHER"; CHR$(7); CHR$(7)
1060 T#=0                 ' CLEAR THE COUNTER
1070 GOTO 550
1080 VDY=VDY+1: MO=MO+1: GOTO 510  ' INCREMENT VOUCHER NUMBER WORK AREAS
1090 GOTO 510
1100 I=1: A$="L"
1110 GOTO 1130
1120 FOR I=1 TO 100
1130 T#=0
1140 IF B$(I)="T" THEN 1080' END OF THIS TRANSACTION
1150 IF MID$(B$(I),32,1)="N" THEN 1170   ' SKIP-NO TRANSACTION
1160 GOSUB 1430          ' WRITE THIS TRANSACTION TO DISK FILE
1170 NEXT I            GET NEXT TRANSACTION
1180 PRINT "ERR-TOO MANY TRANSACTIONS": STOP
1190 LSW=1               ' LAST TRANSACTION SWITCH
1200 GOSUB 1430     ' WRITE LAST TRANSACTION TO DISK FILE
1210 CLOSE 1
1220 PRINT "EOJ"
1230 LOAD "GLMENU",0,R
1240 PRINT CHR$(7);CHR$(7);CHR$(7);CHR$(7);CHR$(7);CHR$(7);CHR$(7)  ENTRY ERROR
1250 A$=224          CLEAR DATA AREA
1260 GOTO 820     ' GO RE-ENTER THE DATA
1270 CLOSE 1      ' TO CHANGE TO NEW DISK-CURRENT DISK FULL
1280 UNLOAD 1
1290 PRINT "CHANGE DISK #1"
1300 INPUT "ENTER -Y- TO CONT.";Y$
1310 IF Y$="Y" THEN 1330
1320 GOTO 1300
1330 MOUNT 1
1340 OPEN R$,F,GL$,D
1350 REC=1
1360 RETURN
1370 IF A$="L" THEN 1190'  LAST TRANSACTIONS TO PROCESS
1380 B$(I)=A$     ' TRANSFER DATA TO MATRIX
1390 GOTO 1000
1400 '
1410 ' GET THE NEXT AVAILABLE DISK SPACE
1420 '
1430 FOR M=1 TO 3
1440 FIELD #1, (M-1)*42 AS D$,42 AS D1$(M)
1450 IF WSW=1 AND MID$(B$(I),1,2)<>MID$(D1$(M),1,2) THEN 1530
1460 IF MID$(D1$(M),1,3)="EOF" THEN 1530 ' END OF LAST ENTRY TO FILE
1470 IF MID$(D1$(M),1,3)<"001" THEN 1530 ' IS THE AREA BLANK
1480 NEXT M
1490 REC=REC+1     ' INCREMENT THE DISK RECORD COUNTER
1500 IF REC=2037 THEN GOSUB 1270 ' IS THE DISK FULL
1510 GET #1,REC     ' GET THE NEXT DISK RECORD
1520 GOTO 1430
1530 IF LSW=1 THEN 1580  ' IS THIS THE LAST TRANSACTION
1540 WSW=1     ' TURN ON FIRST AVAILABLE SPACE SWITCH
1550 RSET D1$(M)=MID$(B$(I),1,42) ' TRANSFER MATRIX DATA TO DISK AREA
1560 PUT #1,REC                   ' WRITE THE DISK RECORD
1570 RETURN
1580 LSET D1$(M)="EOF"       ' WRITE THE END OF FILE TRAILER RECORD
1590 GOTO 1560
1600 END
```

Figure 28. GL6 Program Listing

Program GL7

This program produces the monthly and Y.T.D. budgets and the monthly and Y.T.D. statistical analysis. It uses a set of budget figures provided by the user and contained in a set of data statements. The figures represent the user's estimated monthly guestimates as to what will be produced or spent in a particular ledger account during an average month for the duration of the

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```
450 DATA 7400, 413.50, 7401, 00, 7402.26.50, 7403.800.00, 7404.19.00
460 DATA 7405.167.00, 7406.18.00, 7407.100.00, 7408.9181.10
470 DATA 7409.815.00, 7410.27.00, 7411.200.00, 7412.665.00, 7413, .00
480 DATA 7414, 00, 7415, 00, 7500.10.00, 7501.290.00, 7502.5.00
490 DATA 7503.500.00, 7504.527.05, 7600.250.00, 7601.100.00
500 DATA 7602.200.00, 7603.115.00, 7604.25.00, 7605.35.00, 7606.100.00
510 DATA 7607.10.00, 7608.30.00, 7609.50.00, 7610.25.00, 7611.15.00
520 DATA 7612.90.00, 7613.146.75, 7614.80.00, 7615, 00, 7700.585.00
530 DATA 7701.570.00, 7702.56.00, 7707.240.00, 7800.210.00
540 DATA 7801.214.50, 7900.125.00, 7901.325.00, 7902.1075.00
550 DATA 7905.5820.92, 7906, 00, 7416, 00.4206, 00.7417, 00.4207, .00?
560 DATA 7416, 00.9999.9999
570   PAGE HEADING FOR ALL REPORTS
580
590 S1$="INCOME & EXPENSE ANALYSIS PER OCCUPIED & AVAILABLE ROOM"
600 S4$="BUDGET        ACTUAL        ACTUAL"
610 S5$="PER OCCUP     PER OCCUP     PER AVAIL"
620 H1$="CONWAY R.I.  INC.   CONWAY, ARK."
630 H2$="BUDGETED OPERATING STATEMENT"
640 H3$="PREPARED WITHOUT AUDIT"
650 H4$="FOR PERIOD ENDING "
660 H5$="ACCT                                    MONTHLY       MONTHLY       "
670 H6$="MONTHLY       MONTHLY"
680 H7$="NUMB     DESCRIPTION                    BUDGET        REPORT     OV"
690 H8$="ER/UNDER        O/U%"
700 H9$="ACCT"
710 H=4
720 EDT$="#,###,###.##-":BLK$="  "
730 HM$="MONTHLY"
740 HY$="Y.T.D."
750 J=4
760 F1#=1898!      ' BUDGETED NUMBER OF RENTED ROOMS
770 G1#=16.5       ' BUDGETED AVERAGE ROOM RATE
780 H1#=80!        ' BUDGETED OCCUPANCY RATE
790 PRINT "OPERATING STATEMENT - BUDGET RUN"
800 INPUT "ENTER -M- FOR MONTHLY -Y- FOR Y.T.D.";MY$
810 IF MY$<>"M" AND MY$<>"Y" THEN 350
820 INPUT "ENTER REPORT DATE AS MO-DY-YR";DT$
830 IF MY$="Y" THEN INPUT "ENTER ROOMS RENTED Y.T.D.";RM#:GOTO 850
840 INPUT "ENTER ROOMS RENTED THIS MONTH";RM#
850 F2#=RM#
860 INPUT "ENTER -S- FOR STATISTICAL ANALYSIS";SA$
870 IF MY$="Y" THEN 3590   GO TO YTD FILE START AND 1ST DISK RECORD
880 OPEN "I",1,"BUDGET",1
890 GOSUB 3290'                GO PRINT PAGE HEADINGS
900 LPRINT SPC(10) "INCOME":GOSUB 3270
910 LPRINT:GOSUB 3270
920 LPRINT "ROOM-TEL-MEETING ROOM SALES":GOSUB 3270
930 IF MY$="Y" THEN 950
940 GOSUB 2900
950 GOSUB 3140'              GO GET BUDGET FIGURE FROM TABLE
960 H2#=VAL(DOL$)      ' ACTUAL FIGURES FROM DISK FILE
970 H3#=H2#-H1#        ' OVER OR UNDER THE BUDGET FIGURE
980 IF H1#=0 THEN A4#=0:GOTO 1010  ' OVER/UNDER %
990 A4#=H3#/H1#
1000 A4#=(A4#*100)
1010 IF DAC$="4100" THEN SG2#=SG2#-A2#'  CHANGE SIGN FROM - TO +
1020 C1$=MID$(DAC$,1,2)      ' SET UP COMPARE FIELDS FOR REPORT TOTALS
1030 C2$=MID$(DAC$,1,1)
1040 IF SA$="S" THEN 4470    ' DO YOU WANT STATISCAL ANALYSIS REPORT
1050 '
1060 ' PRINT REPORT LINE
1070 '
1080 LPRINT DAC$;BLK$;DIS$;SPC(1);BLK$ USING EDT$;H1#,H2#,H3#,A4#
1090 GOSUB 3270              TO CHECK FOR PAGE OVERFLOW
1100 '
1110 B1#=B1#+H1#     ' INCREMENT ALL REPORT COUNTERS
1120 C1#=C1#+H1#     ' ALL 1'S COUNTERS = BUDGET PROJECTION FROM TABLE
1130 D1#=D1#+H1#     ' ALL 2'S COUNTERS = ACTUAL FIGURES BEING ANALIZED
1140 B2#=B2#+H2#     ' ALL 3'S COUNTERS = OVER/UNDER BUDGET FIGURES
1150 C2#=C2#+H2#     ' ALL 4'S COUNTERS = OVER/UNDER BUDGET %
1160 D2#=D2#+H2#     ' -A- COUNTERS = REPORT LINE FIGURES
1170 B3#=B3#+H3#     ' -B- COUNTERS = ACCOUNT NUMBER SUB TOTALS
1180 C3#=C3#+H3#     ' -C- COUNTERS = TYPE NUMBER SUB TOTALS
1190 D3#=D3#+H3#     ' -D- COUNTERS = FINAL TOTALS
```

next 12 months. In short, they are 12 monthly averages. The BUDGET file which is produced by GL2 and written on the end of the ledger floppy each time GL2 is run contains only the monthly actual figures which were extracted from the ledger. The ledger balance forwards are used for the Y.T.D. actual figures. Therefore this program actually works with two different data files, depending on whether you are running the monthly or Y.T.D. run. The same holds true for the statistical reports. The statistical reports extend the budget one step further and break down all the figures on a per-unit basis. In my case it is motel rooms occupied and available whether occupied or not. You can modify this portion to suit your own needs.

```
10   PROGRAM NAME "GL7"
20   PROGRAMMED BY      BUD SHAMBURGER          NOVEMBER 1976
30
40
50
60
70   A PROGRAM TO PRODUCE IN-HOUSE BUDGET AND STATISTICAL REPORTS
80   THE REPORTS ARE NOT INTENDED TO BE USED FOR GENERAL CIRCULATION
90   BUT FOR MANAGEMENT DECISION MAKING AND PLANNING
100
110    THIS PROGRAM RUNS THE BUDGET IN TWO PASSES.   THE 1ST PASS
120    PRODUCES THE MONTHLY BUDGET.  THE 2ND PASS PRODUCES THE YTD
130    BUDGET.  ONE FISCAL YEAR RUNS FROM 6-1 THRU 5-21
140    THE PROGRAM DETERMINES THE MONTHLY FIGURES BY TAKING
150    THEM FROM A CONSECTIVE FILE NAMED "BUDGET" CREATED WHEN
160    RUNNING THE GENERAL LEDGER.   THIS FILE RESIDES ON THEN
170    END OF THE GENERAL LEDGER DISK.   THE YTD FIGURES USED IN
180    THIS PROGRAM ARE THIS MONTHS YTD BAL FWDS OF THE GENERAL LEDGER
190
200    IT ALSO RUNS THE MONTHLY & YTD STATISTICAL REPORTS IN 2 PASSES
210   THE STATISTICAL REPORTS ARE THE ACTUAL MONTHLY AND YTD FIGURES
220   DIVIDED BY THE TOTAL OCCUPIED AND AVAILABLE ROOMS.  GIVING YOU
230   THE INCOME AND EXPENSES ON A PER UNIT BASIS.
240
250
260   ************************************************************
270
280 CLEAR 1000
290 INPUT "TO MOUNT THE FILES ENTER -Y-";YX$
300 IF YX$<>"Y" THEN 380
310 UNLOAD 1 MOUNT 1
320
330   TABLE CONTAINING THE LEDGER ACCOUNT NUMBER AND THE PROJECTED
340   MONTHLY BUDGET AMOUNT FOR THAT ACCOUNT
350
360 DATA 4100,-27100.00,4101,-200.00,4102,-990.00,4200,-14.00
370 DATA 4201,-1300.00,4203,-500.00,4204,-26.00,4205,-60.00
380 DATA 4300,-100.00,4301,-100.00,4302,-215.00,4303,-12.00
390 DATA 4304,-245.00,4305,-50.00,4306,-25.00,7100,1500.00
400 DATA 7101,1500.00,7102,250.00,7103,240.00,7104,1650.00
410 DATA 7105,300.00,7106,135.00,7107,470.00,7108,90.00
420 DATA 7109,200.00,7110,24.00,7111,27.50,7112,20.00,7113,17.00
430 DATA 7114,00,7115,00,7200,750.00,7201,552.00,7202,33.00
440 DATA 7300,105.00,7301,215.00,7302,292.00,7303,5.50,7304,50.00
```

```
1200 IF DAC$="7903" THEN 1250     NO ADD - DEPRECIATION FOR CASH FLOW
1210 IF DAC$="7408" THEN 2220' COMPUTE PRINC & INTEREST FOR CASH FLOW
1220 E1#=E1#+A1#        -E- COUNTERS = CASHFLOW LINE TOTALS
1230 E2#=E2#+B2#
1240 E3#=E2#-E1#
1250 IF MY$="Y" THEN GOSUB 3830:GOTO 1270' GO GET YTD FIGURES FROM DISK
1260 GOSUB 2900       GO GET THE MONTHLY BUDGET DISK FILE
1270 IF DAC$<"0001" THEN 2270'   LAST DISK RECORD HAS BEEN PROCESSED
1280 IF C1$<MID$(DAC$,1,2) THEN 1350   GO PRINT LEVEL B TOTALS
1290 IF C1$>MID$(DAC$,1,2) THEN 1310   SEQ ERROR
1300 GOTO 950
1310 PRINT "SEQ ERROR ";C1$;" ";MID$(DAC$,1,2) STOP
1320
1330   ROUTINE TO BREAK FOR  TYPE  TOTALS
1340
1350 IF C1$="41" THEN 1920
1360 IF C1$="42" THEN 1950
1370 IF C1$="43" THEN 1980
1380 IF C1$="71" THEN 2010
1390 IF C1$="72" THEN 2040
1400 IF C1$="73" THEN 2070
1410 IF C1$="74" THEN 2100
1420 IF C1$="75" THEN 2130
1430 IF C1$="76" THEN 2160
1440 IF C1$="77" THEN 2190
1450
1460   THEN TOTAL OUT TYPE  78  AND SET UP FOR TYPE  79
1470
1480 CAT$="TOTAL RESERVATION EXPENSE"
1490 NCAT$="INSURANCE-TAXES-DEPRECIATION"
1500 SP=27-LEN(CAT$)
1510 IF B1#=0 THEN B4#=0 GOTO 1540
1520 B4#=B3#/B1#
1530 B4#=(B4#*100)
1540 LPRINT GOSUB 3270
1550 IF SA$="S" THEN 4540
1560 LPRINT CHT$;SPC(SP) USING EDT$;B1#,B2#,B3#,B4#
1570 GOSUB 3270
1580 B1#=0 B2#=0 B3#=0 B4#=0
1590 LPRINT GOSUB 3270
1600 LPRINT NCAT$
1610 GOSUB 3270
1620 IF EFSW=1 THEN 2310     IS IT END OF TYPE  79  AND EOJ
1630
1640   CHECK FOR INCOME TOTAL OR FINAL TOTAL
1650
1660 IF C2$<MID$(DAC$,1,1) THEN 1700
1670 IF C2$>MID$(DAC$,1,1) THEN 1310   SEQ ERROR
1680 GOTO 950
1690
1700 CAT$="TOTAL INCOME"   SET UP FOR TOTAL INCOME PRINTING
1710 SP=27-LEN(CAT$)
1720 IF C1#=0 THEN C4=0 GOTO 1750
1730 C4#=C2#/C1#
1740 C4#=(C4#*100)
1750 LPRINT GOSUB 3270
1760 IF SA$="S" THEN 4610   DO YOU WANT STATISTICAL REPORT
1770 LPRINT CHT$;SPC(SP) USING EDT$;C1#,C2#,C4#   PRINT TOT INC LINE
1780 C1#=0 C2#=0 C3#=0 C4#=0   CLEAR TYPE COUNTERS
1790 GOSUB 3270
1800 IF EFSW=1 THEN 2130
1810 GOSUB 3270
1820 LPRINT GOSUB 3270      CHECK FOR PAGE OVERFLOW
1830 LPRINT SPC(10) "EXPENSES"     SET UP FOR EXPENSES
1840 GOSUB 3270      CHECK FOR PAGE OVERFLOW
1850 LPRINT GOSUB 3270
1860 LPRINT "COST OF ROOM SALES"
1870 GOSUB 3270          CHECK FOR PAGE OVERFLOW
1880 GOTO 950            CONTINUE WITH REPORT
1890
1900   THE FOLLOWING ROUTINES LOAD THE DESCRIPTIONS INTO THE PRINT AREA
1910
1920 CAT$="TOT ROOM-TELE-MEETING INC"
1930 NCAT$="MISCELLANEOUS SALES"
1940 GOTO 1500
```



```
1950 CAT$="TOTAL MISCELLANEOUS SALES"
1960 NCAT$="SALES-OTHER"
1970 GOTO 1500
1980 CAT$="TOTAL SALES-OTHER"
1990 NCAT$=" "
2000 GOTO 1500
2010 CAT$="TOTAL COST OF ROOM SALES"
2020 NCAT$="COST OF TELEPHONE SERVICE"
2030 GOTO 1500
2040 CAT$="TOT COST OF TELEPHONE SER"
2050 NCAT$="COST OF OTHER SALES"
2060 GOTO 1500
2070 CAT$="TOTAL COST OF OTHER SALES"
2080 NCAT$="GENERAL & ADMINISTRATIVE EXPENSE"
2090 GOTO 1500
2100 CAT$="TOT GENERAL & ADM EXPENSE"
2110 NCAT$="ADVERTISING & PROMOTION"
2120 GOTO 1500
2130 CAT$="TOT ADVERTISING-PROMOTION"
2140 NCAT$="REPAIRS & MAINTENANCE"
2150 GOTO 1500
2160 CAT$="TOTAL REPAIRS & MAINTENANCE"
2170 NCAT$="UTILITIES"
2180 GOTO 1500
2190 CAT$="TOTAL UTILITIES"
2200 NCAT$="RESERVATION EXPENSE"
2210 GOTO 1500
2220 IF MY$="Y" THEN A2#=10711 8*XNO   COMPUTE YTD PRINCIPLE & INTEREST
2230 IF MY$="Y" THEN A1#=10711 8*XNO GOTO 2260
2240 A2#=10711 8                      MONTHLY PRINCIPLE & INTEREST
2250 A1#=10711 8
2260 GOTO 1220
2270 EFSW=1                  END OF DISK FILE SWITCH
2280 CAT$="TOT INS-TAXES-DEPREC"
2290 NCAT$=" "
2300 GOTO 1500
2310 CAT$="TOTAL EXPENSES"
2320 GOTO 1710
2330 LPRINT GOSUB 3270        SPACE DOWN 2 LINES
2340 LPRINT GOSUB 3270
2350 CAT$="NET PROFIT(-) OR LOSS(+)"   SET AND PRINT PROFIT/LOSS LINE
2360 SP=27-LEN(CAT$)
2370 IF D1#=0 THEN D4=0 GOTO 2410
2380 D4#=D3#/D1#
2390 D4#=(D4#*100)
2400 IF SA$="S" THEN 4680
2410 LPRINT CAT$;SPC(SP) USING EDT$;D1#,D2#,D3#,D4#
2420 GOSUB 3270
2430 LPRINT GOSUB 3270        SPACE DOWN 2 LINES
2440 LPRINT GOSUB 3270
2450 CAT$="CASH FLOW"         SET UP AND PRINT CASH FLOW LINE
2460 SP=27-LEN(CAT$)
2470 IF E1#=0 THEN E4=0 GOTO 2510
2480 E4#=E3#/E1#
2490 E4#=(E4#*100)
2500 IF SA$="S" THEN 4750
2510 LPRINT CAT$;SPC(SP) USING EDT$;E1#,E2#,E3#,E4#
2520 GOSUB 3270
2530 CAT$="NUMBER ROOMS RENTED"   SET UP AND PRINT ROOMS RENTED LINE
2540 SP=27-LEN(CAT$)
2550 IF MY$="Y" THEN F1#=F1#*XNO
2560 F3#=F2#-F1#
2570 IF F1#=0 THEN F4=0 GOTO 2600
2580 F4#=F3#/F1#
2590 F4#=(F4#*100)
2600 LPRINT GOSUB 3270
2610 LPRINT GOSUB 3270
2620 LPRINT CAT$;SPC(SP) USING EDT$;F1#,F2#,F3#,F4#
2630 GOSUB 3270
2640 LPRINT GOSUB 3270
2650 LPRINT GOSUB 3270
2660 CAT$="AVERAGE ROOM RATE"   SET UP AND PRINT AVER ROOM RATE LINE
2670 SP=27-LEN(CAT$)
```

```
2680 G2#=SG2#/RM#
2690 G3#=G2#-G1#
2700 G4#=G3#/G1#
2710 G4#=(G4#*100)
2720 LPRINT CAT$;SPC(SP) USING EDT$;G1#,G2#,G3#,G4#
2730 GOSUB 3270
2740 LPRINT GOSUB 3270
2750 LPRINT GOSUB 3270
2760 CAT$="OCCUPANCY RATE"   SET UP AND PRINT OCCUP RATE LINE
2770 SP=27-LEN(CAT$)
2780 IF MY$="Y" THEN H2#=RM#/(2372.5*XMO)  GOTO 2800 ' IS IT YTD REPORT
2790 H2#=RM#/2372.5
2800 H2#=H2#*100
2810 H3#=H2#-H1#
2820 H4#=H3#/H1#
2830 H4#=(H4#*100)
2840 LPRINT CAT$;SPC(SP) USING EDT$;H1#,H2#,H3#,H4#
2850 IF MY$="Y" THEN CLOSE 2 GOTO 2870   CLOSE LEDGER FILE
2860 CLOSE 1                             CLOSE MONTHLY BUDGET FILE
2870 PRINT "EOJ"
2880 LOAD "GLMENU",0,R
2890
2900    THIS ROUTINE GET THE MONTHLY BUDGET FIGURES FROM THE DISK
2910
2920 IF J>4 THEN PRINT "LOOP ERROR" STOP
2930 IF J>1 THEN 2990
2940 DAC$=MID$(A$(J),7,4)
2950 DIS$=MID$(A$(J),11,20)
2960 DOL$=MID$(A$(J),31,11)
2970 I=J+1
2980 RETURN
2990 E=EOF(1)
3000 IF E=-1 AND J=4 THEN 2270   EVEN ENDED FILE-LAST RECORD PROCESSED
3010 IF E=-1 THEN PRINT "DISK ACESS ERROR" STOP
3020 INPUT #1,B$
3030 I=1
3040 A$(I)=MID$(B$,1,42)
3050 I=I+1
3060 A$(I)=MID$(B$,43,84)
3070 I=I+1
3080 A$(I)=MID$(B$,85,126)
3090 J=1
3100 GOTO 2940
3110
3120    THIS ROUTINE GETS THE BUDGET FIGURE FROM THE DATA TABLE
3130
3140 FOR I=1 TO 500
3150 READ X$,Y#
3160 IF DAC$=X$ THEN 3190
3170 IF X$="9999" THEN 3190
3180 NEXT I
3190 PRINT "NO DATA IN TABLE FOR ";DAC$
3200 Y#=0 GOTO 3220
3210 RESTORE
3220 RETURN
3230 H1#=Y#
3240 IF X$="T" THEN H1#=H1#*XMO
3250 GOTO 3180
3260
3270    THIS ROUTINE CHECKS FOR PAGE OVERFLOW AND PRINTS THE
3280    PAGE HEADINGS
3290
3300 LCT=LCT+1
3310 IF LCT>57 THEN GOSUB 3360   TO PAGE OVERFLOW ROUTINE
3320 RETURN
3330
3340   PAGE OVERFLOW ROUTINE
3350
3360 FOR L=LCT TO 66
3370 LPRINT
3380 NEXT L
3390 LPRINT SPC(28) H1$ LPRINT
3400 IF MY$="Y" THEN 3530
3410 LPRINT SPC(34) HM$
3420 IF SH$="S" THEN LPRINT SPC(10);H3$ GOTO 3440
3430 LPRINT SPC(28)H2$
3440 LPRINT SPC(28)H3$
3450 LPRINT SPC(28)H4$;"%"
3460 IF MY$="M" THEN LPRINT LPRINT LPRINT GOTO 3480
3470 LPRINT SPC(28);"MONTH ";XMO;" OF FISCAL YEAR" LPRINT LPRINT
3480 IF SH$="S" THEN 4310
3490 IF MY$="Y" THEN 3550
3500 LPRINT H6$,H8$ LPRINT H7$,H9$ LPRINT
3510 LCT=12
3520 RETURN
3530 LPRINT SPC(35) MY$
3540 GOTO 3420
3550 LPRINT H3$;SPC(29);MY$;SPC(7);MY$;SPC(7);MY$;SPC(6);MY$
3560 LPRINT H7$,H8$ LPRINT
3570 GOTO 3510
3580
3590   THIS ROUTINE SETS UP TO RUN THE YTD BUDGET USING
3600     THE GENERAL  LEDGER BAL FWDS FOR THE DATE ENTERED + 1MO
3610
3620 OPEN "R",2,"LEDGER",1
3630 GMO$=MID$(G7$,1,2)
3640 GYR$=MID$(G7$,7,2)
3650 GMO=VAL(GMO$)
3660 GYR=VAL(GYR$)
3670 IF GMO=12 THEN GMO=1:GYR=GYR+1 GOTO 4080  TO COMPUTE YTDMO
3680 GMO=GMO+1 GOTO 4080     TO COMPUTE YTDMO
3690 GMO$=STR$(GMO) GYR$=STR$(GYR)
3700 IF LEN(GMO$)<3 THEN GD$="0"+MID$(GMO$,2,2)+MID$(GYR$,2,2) GOTO 3720
3710 GD$=MID$(GMO$,2,2)+MID$(GYR$,2,2)
3720 GET #2,2037      GET TABLE LOCATED IN RECORD 2037
3730 FOR I=1 TO 16
3740 FIELD #2, (I-1)*8 AS D$,8 AS D2$,I
3750 IF GD$=MID$(D2$,1,4) THEN 3780   IS IT EQUAL TO CURRENT DATE
3760 NEXT I
3770 PRINT "FILE NOT IN TABLE" STOP
3780 REC=MID$(D2$,5,4)
3790 REC=VAL(REC$)      LOAD THE FILE STARTING ADDRESS
3800 GOSUB 3830          GO GET 1ST DISK RECORD FROM DISK FILE - YTD
3810 GOTO 890             GO RUN REPORT
3820
3830    THIS ROUTINE GETS THE YTD BUDGET FIGURES FROM THE DISK
3840    LEDGER FILE-BALANCE FORWARD FIGURES FOR ACCOUNTS
3850    4000 AND UP
3860
3870 IF N=4 THEN 3930
3880 FOR M=N TO 3
3890 FIELD #2, (M-1)*42 AS D$,42 AS DREC$(M)
3900 IF MID$(DREC$(M),1,3)="EOF" AND ESN=1 THEN 4270
3910 IF MID$(DREC$(M),1,3)<>ATD$(GLN,1,3) THEN 3960
3920 NEXT M
3930 REC=REC+1
3940 IF REC>705 THEN PRINT "DISK AREA OVERFLOW" STOP
3950 GET #2,REC
3960 N=1
3970 GOTO 3870
3980 IF MID$(DREC$(M),5,2)=MID$(GD$,3,2) THEN 4000
3990 GOTO 3920
4000 ESN=1
4010 IF MID$(DREC$(M),42,1)="1" OR MID$(DREC$(M),42,1)="4" THEN 3920
4020 DAC$=MID$(DREC$(M),7,4)
4030 DIS$=MID$(DREC$(M),11,20)
4040 DOL$=MID$(DREC$(M),31,11)
4050 N=M+1
4060 RETURN
4070
4080    THIS ROUTINE SETS UP XMO=TO THE MONTH Y T D  FOR MULTIPLING
4090    OUT THE PROPER YTD BUDGET AMOUNT   IT TAKES INTO CONSIDERATION
4100    THAT GMO HAS ALREADY BEEN INCREASED BY ONE MONTH
4110   XMO WILL EQUAL THE FISCAL MONTH YEAR TO DATE MINUS 1
4120
4130 IF GMO=7 THEN XMO=1 GOTO 3690   JUNE
4140 IF GMO=8 THEN XMO=2 GOTO 3690   JULY
4150 IF GMO=9 THEN XMO=3 GOTO 3690  AUGUST
4160 IF GMO=10 THEN XMO=4 GOTO 3690  SEPTEMBER
4170 IF GMO=11 THEN XMO=5 GOTO 3690   OCTOBER
4180 IF GMO=12 THEN XMO=6 GOTO 3690   NOVEMBER
4190 IF GMO=1 THEN XMO=7 GOTO 3690   DECEMBER
4200 IF GMO=2 THEN XMO=8 GOTO 3690   JANUARY
4210 IF GMO=3 THEN XMO=9 GOTO 3690   FEBRUARY
4220 IF GMO=4 THEN XMO=10 GOTO 3690  MARCH
4230 IF GMO=5 THEN XMO=11 GOTO 3690  APRIL
4240 IF GMO=6 THEN XMO=12 GOTO 3690  MAY
4250 PRINT "GMO ERROR" STOP
4260
4270   THE FOLLOWING ROUTINES SET UP THE PROGRAM TO PRODUCE THE
4280    STATISTICAL REPORTS BASED ON OCCUPIED AND AVAILABLE ROOMS
4290    EITHER MONTHLY OR YTD
4300
4310 IF MY$="Y" THEN OM#=RM#/(23.725*XMO) AV=1898*XMO AX=2372.5*XMO GOTO 4350
4320 OM#=RM#/23.725
4330 AV=1898
4340 AX=2372.5
4350 S2$="BUDGETED AVERAGE##.### ## ACTUAL       ##.### ##"
4360 S2$=S2$+"   ACTUAL AVERAGE ##.### ##"
4370 S3$="OCCUPIED ROOMS = ##.##%   OCCUPIED ROOMS = ##.##%"
4380 S3$=S3$+"  AVAILABLE ROOMS = 100.00%"
4390 LPRINT USING S2$ AV,RM#,AX
4400 LPRINT USING S3$,OM#
4410 LPRINT LPRINT
4420 LPRINT "ACCT";SPC(28);S4$
4430 LPRINT "NUMB     DESCRIPTION" SPC(10);S5$
4440 LPRINT
4450 LCT=16
4460 GOTO 2520
4470 IF MY$="Y" THEN S1#=A1#/(1898*XMO) GOTO 4490   DIVIDE FOR OCCUPIED RMS
4480 S1#=A1# 1898
4490 S2#=B2#.RM#
4500 IF MY$="Y" THEN S3#=A2#/(2372.5*XMO) GOTO 4520   DIVIDE FOR AVAIL RMS
4510 S2#=B2#.2372.5
4520 LPRINT DAC$ EDT$;DIS SPC(1);DOL$ USING EDT$;S1#,S2#,S3#
4530 GOTO 1050
4540 IF MY$="Y" THEN P1#=S1#/(1898*XMO) GOTO 4560
4550 P1#=S1# 1898
4560 P2#=B2#.RM#
4570 IF MY$="Y" THEN P3#=S3#/(2372.5*XMO) GOTO 4590
4580 P3#=B2#/2372.5
4590 LPRINT CAT$;SPC(SP) USING EDT$;P1#,P2#,P3#
4600 GOTO 1500
4610 IF MY$="Y" THEN O1#=C1#/(1898*XMO) GOTO 4630
4620 O1#=C1#/1898
4630 O2#=C2#/RM#
4640 IF MY$="Y" THEN O3#=C2#/(2372.5*XMO) GOTO 4660
4650 O3#=C2#/2372.5
4660 LPRINT CAT$;SPC(SP) USING EDT$,O1#,O2#,O3#
4670 GOTO 1780
4680 IF MY$="Y" THEN R1#=D1#/(1898*XMO) GOTO 4700
4690 R1#=D1#/1898
4700 R2#=D2#/RM#
4710 IF MY$="Y" THEN R3#=D2#/(2372.5*XMO) GOTO 4730
4720 R3#=D2#/2372.5
4730 LPRINT CAT$;SPC(SP) USING EDT$,R1#,R2#,R3#
4740 GOTO 2420
4750 IF MY$="Y" THEN V1#=E1#/(1898*XMO) GOTO 4770
4760 V1#=E1#/1898
4770 V2#=E2#/RM#
4780 IF MY$="Y" THEN V3#=E2#/(2372.5*XMO) GOTO 4800
4790 V3#=E2#/2372.5
4800 LPRINT CAT$;SPC(SP) USING EDT$,V1#,V2#,V3#
4810 GOTO 2850
4820 END
```

Figure 29. GL7 Program Listing

Program COPRAN

This is a general purpose utility program used throughout the general ledger package. It is used for transferring data from one file to the next, for copying files, for copying portions of files, etc. This version is almost the same as that version included with the Payroll Package in the June issue of INTERFACE AGE. However, this version has been modified to work with the program GLMENU and to support the general ledger package of programs.

```
10   PROGRAM NAME "COPRAN"
20 ' MITS BASIC VERSION 4.0
30 ' PROGRAMMED BY:  BUD SHAMBURGER      JAN 1977

40 '
50 ' A GENERAL PURPOSE UTILITY PROGRAM FOR COPYING RANDOM DATA FILES.
60 ' FILE NAMES, FILE NUMBERS AND DISK DRIVE NUMBERS ARE ENTERED FROM
70 '  THE TERMINAL.  FILE BOUNDARIES ARE ALSO ENTERED FROM THE TERMINAL.
80 ' BOTH FILES CAN RESIDE ON THE SAME DISK DRIVE PROVIDED THEIR NAMES
90 ' ARE DIFFERENT
100 '
110 '*****************************************************************
120 ' *****************************************************************
130 '
140 CLEAR 500
150 PRINT "COPY * BASIC-RANDOM-FILES *"
160 PRINT
170 LET R$="R"
180 LET S=1
190 LET Q=2
200 INPUT "ENTER -INPUT- FILE NAME";I$
210 INPUT "ENTER -OUTPUT- FILE NAME";O$
220 INPUT "ENTER -INPUT- DR#";X
230 INPUT "ENTER -OUTPUT- DR#";Y
240 INPUT "ENTER -INPUT- BEG REC#";T
250 INPUT "ENTER -INPUT- END REC#";U
260 INPUT "ENTER -OUTPUT- BEG REC#";V
270 INPUT "ENTER -OUTPUT- END REC#";W
280 INPUT "TO MOUNT THE FILES ENTER -Y-";XY$
290 IF XY$<>"Y" THEN 320
300 IF X=Y THEN UNLOAD X:MOUNT X:GOTO 320
310 UNLOAD X,Y:MOUNT X,Y
320 LET ZT=U-T
330 LET ZV=W-V
340 IF X<20 AND X<21 THEN 570
350 IF Y<20 AND Y<21 THEN 570
360 IF ZT<ZV THEN 590
370 OPEN R$,X,I$,X
380 OPEN R$,Q,O$,Y
390 GOSUB 540
400 IF T>U THEN 610
410 GET #1,T
420 FIELD #1,128 AS A$
430 LET C$=A$
440 FIELD #2,128 AS B$
450 RSET B$=C$
460 PUT #2,V
470 IF CT=11 THEN GOSUB 540
480 PRINT USING "####  ";X;T
490 PRINT USING "####  ";Y;V
500 LET CT=CT+1
510 LET T=T+1
520 LET V=V+1
530 GOTO 400
540 LET CT=0
550 PRINT "  DR#  REC#"
```

```
560 RETURN
570 PRINT "ERROR IN DR#"
580 GOTO 220
590 PRINT "INPUT AREA & OUTPUT AREA UNEQUAL"
600 GOTO 240
610 CLOSE 5,0
620 PRINT "END OF COPY"
630 LOAD "GLMENU",0,R
640 END
```

Figure 30. COPRAN Program Listing

Program GETPUT

This is another utility program used for changing data in any of the general ledger random data files. You can insert or delete from 1 to 128 characters to any sector. It dumps the sector on the terminal and identifies each position, lets you enter your new data, then writes out the new data and displays them on the terminal.

This program also appeared in the Payroll Package in the June issue of INTERFACE AGE. However, like all programs in the package, it works in conjunction with GLMENU to service the whole general ledger package.

```
10 ' PROGRAM NAME "GETPUT"
20 ' PROGRAMMED BY:  BUD SHAMBURGER      JAN 1977

30 '
40 ' A GENERAL PURPOSE UTILITY PROGRAM FOR DUMPING A RANDOM FILE
50 ' ON THE TERMINAL, EXAMINING ITS CONTENTS, AND ALTERING
60 ' IT BY TYPING IN THE LIMITS OF THE DESIRED FIELD
70 ' AND THEN ENTERING THE NEW DATA.  THE NEW RECORD IS THEN DUMP ON
80 ' THE TERMINAL FOR VISUAL INSPECTION.
90 ' AND ENTIRE DISK RECORD CAN BE CREATED USING THIS PROGRAM OR AS
100 ' LITTLE AS ONE CHARACTER CAN BE ENTERED OR CHANGED.
110 ' EACH POSITION IN THE 128 CHARACTER RECORD IS IDENTIFIED JUST
120 ' ABOVE ITS PRINT LOCATION.
130 '
140 '*************************************************************
150 '*************************************************************
160
170 CLEAR 500
180 BLK$=""
190 INPUT "ENTER FILE NAME";N$
200 INPUT "FILE NUMBER";F
210 INPUT "DRIVE NUMBER";D
220 INPUT "DO YOU WANT THE FILE MOUNTED -Y- FOR YES";Y$
230 IF Y$="Y" THEN UNLOAD D:MOUNT D
240 R$="R"
250 OPEN R$,F,N$,D
260 FIELD F,128 AS A$
270 LET C=1
280 INPUT "ENTER -A- TO LOAD GLMENU";CC$
290 IF CC$="A" THEN LOAD "GLMENU",0,R
300 INPUT "ENTER ADDR";C
310 GET F,C
320 A1$="1...5....0....5....0....5....0....5....0"
330 A2$="     1    2    3    4"
340 A3$="    5....0....5....0....5....0....5....0"
350 A4$="     4    5    6    7    8"
360 A5$="....5...8"
370 A6$="    8    9    0    1    2"
380 A7$="    2"
390 PRINT A2$;A4$
400 PRINT A1$;A3$
410 PRINT MID$(A$,1,80)
420 PRINT A6$;A7$
430 PRINT A3$;A5$
440 PRINT MID$(A$,81,128)
450 INPUT "ENTER FIELD LIMITS AS XXX-XXX";B1$
460 B2$=MID$(B1$,1,3):B2=VAL(B2$)
470 B3$=MID$(B1$,5,3):B3=VAL(B3$)
480 K=B3-B2+1
490 IF K>128 THEN PRINT "FIELD SIZE ERROR":GOTO 450
500 PRINT "ENTER NEW DATA"
510 INPUT B$
520 C$=A$
530 MID$(C$,B2,K)=B$
540 LSET A$=C$
550 PUT F,C
560 PRINT A2$;A4$
570 PRINT A1$;A3$
580 PRINT MID$(C$,1,80)
590 PRINT A6$;A7$
600 PRINT A3$;A5$
610 PRINT MID$(C$,81,128)
620 GOTO 270
630 END
```

Figure 31. GETPUT Program Listing

Program SORTGL

This program does all the sorting necessary to produce all the reports for the general ledger package. It will sort up to 1750 blocked records in a 64K machine. It is a sort-in-place program. That is, the sorted file will end up in exactly the same place as it originated. The SORT always goes from drive 1 to drive 0. If you only have one disc drive, then you have many modifications to make. Not only to this program but to the whole package. The SORT is monitored on the terminal and a hard copy record of the SORT is printed on the line printer. The hard copy gives the name of the SORT, the date, the locations of the files, and where the EOF trailer record is written. This is very useful for copying portions of the files for back-up purposes.

```
10 ' PROGRAM NAME "SORTGL"
20 ' PROGRAMMED BY:      BUD SHAMBURGER     DECEMBER 1976
30 '
40 '
50 '
60 '
70 ' THIS IS A SORT-IN-PLACE PROGRAM.  IT SORTS THE GENERAL LEDGER FILE
80 ' ON DRIVE 1 TO DRIVE 0 THEN COPIES IT BACK TO DRIVE 0 IN THE EXACT
90 ' LOCATION FROM WHICH IT CAME
100 '  IT WILL SORT A MAX OF 1,750 RECORDS.  WHEN SORTING ON CK-VCH#.
110 ' BAL FWDS HAVE A SORT FIELD OF 10,000+,CHECKS 20,000+ AND
120 ' VOUCHERS 30,000+ (THIS IS IN THE SORT FIELD ONLY).  WHEN SORTING
130 ' ON ACCT #. THE SAME ARRANGEMENT IS USED IN THE CK-VCH # FIELD
140 ' CK-VCH# SORT/SORT FIELD = CK-VCH#(B12345)-6 POSITIONS
150 '                    TAG FIELD  = SECTOR ADDR(B1234)+(1)-6 POSITIONS
160 ' ACCT#/CK-VCH# SORT/SORT FIELD = ACCT$/CK-VCH#(B123412345)-10 POS
170 '                    TAG FIELD  = SECTOR ADDR(B1234)+B.F (1)-6 POS
180 ' THE DIM STATEMENTS IN LINES 330 & 340 ALLOCATE 21,000 POSITIONS
190 ' OF MEMORY WHETHER USED OR NOT.  THESE STATEMENTS MAY BE CHANGED
200 ' TO ACCOMODATE LESS MEMORY
210 '
220 '*****************************************************************
230 '
240 INPUT "ENTER 'Y' TO MOUNT THE FILES";WY$
250 IF WY$<>"Y" THEN 280
260 UNLOAD 0,1
270 MOUNT 0,1
280 CLEAR 1000
290 Z=1
300 DIM DM$(3)
310 DIM R$(3)
320 DIM DV$(3)
330 DIM B#(1750)
340 DIM BB(1750)
350 DIM D(16)
360 CNT=10000
370 PRINT "GENERAL LEDGER SORT"
380 OPEN "R",3,"LEDGER",1     ' OPEN ALL FILES
390 OPEN "R",1,"LEDGER",1
400 OPEN "R",2,"LEDGER",0
410 PRINT "ENTER -A- TO SORT ON ACCT#/CK#/VCH#" ' WHAT KIND OF SORT?
420 INPUT "ENTER -C- TO SORT ON CK/VCH #";CA$
430 IF CA$="A" THEN LPRINT "GEN LEDGER SORT ON ACT#/CK-VCH#" GOTO 450
440 LPRINT "GEN  LEDGER SORT ON CK/VCH #"
450 INPUT "ENTER DATE TO BE SORTED AS MO/YR";A$ ' FILE MONTH AND YEAR
460 LPRINT "DATE ";A$
470 GET #3,2037               ' FIND DATE IN TABLE LOCATED IN RECORD 2037
480 FOR Q=1 TO 16               ' MAX OF 16 ENTRIES IN TABLE
490 FIELD #3, (Q-1)*8 AS DB$, 8 AS D1$(Q)
500 IF M$=MID$(D1$(Q),1,4) THEN 540   ' IS THIS THE RIGHT DATE IN TABLE
510 NEXT Q
520 PRINT "DATE NOT IN TABLE"
530 GOTO 530                  ' STOP - STOP - STOP
540 REC$=MID$(D1$(Q),5,4)     ' EXTRACT STARTING ADDRESS OF FILE FROM TABLE
550 REC=VAL(REC$)             ' LOAD REC WITH STARTING ADDRESS
560 K=1
570 SREC=REC                  ' SAVE THE STARTING ADDRESS
580 CLOSE 3                   ' CLOSE THE TABLE FILE
590 GET #1,REC                ' GET THE FIRST RECORD IN THE LEDGER FILE
600 FOR I=1 TO 3              ' LEDGER FILE BLOCKED 3 PER SECTOR
610 FIELD #1, (I-1)*42 AS D$,42 AS DREC$(I)
620 IF MID$(DREC$(I),1,3)="EOF" AND LSW=1 THEN 1070 ' IS IT END OF FILE
630 C#=MID$(DREC$(I),1,2)
640 C$=(C#)+(MID$(DREC$(I),5,2)) ' EXTRACT DATE FROM LEDGER FILE
650 IF A$=C$ THEN LSW=1:GOTO 700 ' IS IT THE BEGINNING OF THE FILE
660 NEXT I          ' NEXT RECORD
670 REC=REC+1       ' INCREMENT THE RECORD COUNTER
680 IF REC=2037 THEN 1040   ' IS IT THE END OF THE FILE AREA
690 GOTO 590        ' GO GET ANOTHER RECORD
700 N=N+1       ' N = THE NUMBER RECORDS CONTAINED IN THIS MONTHS FILE
710 IF N>1750 THEN 1060
720 IF LSW=1 THEN 750
730 LSW=1
740 S1=1
750 IF CA$="C" THEN 920   ' CHECK NUMBER SORT
760 DAC$=MID$(DREC$(I),7,4)
770 IF MID$(DREC$(I),42,1)="1" THEN 1000  ' IS IT A BAL FORWARD RECORD
780 PC$=MID$(DREC$(I),11,5)  ' LOAD CK# VCH# WORK AREA
790 IF MID$(PC$,1,1)="C" THEN MID$(PC$,1,1)="2":GOTO 810 ' IS IT A CHECK
800 MID$(PC$,1,1)="3"   ' THEN ITS A VOUCHER
810 DAC$=DAC$+PC$   ' ADD PC TO DAC
820 I#=STR$(I):RAC=REC
830 RAC=RAC+1000    ' ADD 1000 TO RECORD NUMBER
840 REC$=STR$(RAC)
850 TAG$=MID$(REC$,2,4)+MID$(I$,2,1) ' SAVE REC NUMBER IN TAG
860 DAC#=VAL(DAC$)
870 TAG=VAL(TAG$)
880 B#(K)=DAC#   ' LOAD THE MATRIX FOR SORTING B# = CONTROL NUMBER
890 BB(K)=TAG                        BB = TAG OR RECORD NUMBER
900 K=K+1        ' INCRECMENT MATRIX SUBSCRIPT
910 GOTO 660
920 IF MID$(DREC$(I),42,1)="1" THEN 960   ' IS IT A BAL FWD RECORD
930 DAC#=MID$(DREC$(I),11,5)   ' LOAD THE WORK AREA
940 IF MID$(DAC$,1,1)="C" THEN MID$(DAC$,1,1)="2":GOTO 820 ' IS IT A CHECK
950 MID$(DAC$,1,1)="3":GOTO 820  ' THEN IT IS A VOUCHER
960 CNT=CNT+1    ' BLOCK LOCATION IN THE DISK RECORD
970 CNT$=STR$(CNT)
980 DAC$=MID$(CNT$,2,5)
990 GOTO 820
1000 CNT=CNT+1      ' BLOCK LOCATION IN THE DISK RECORD
1010 CNT$=STR$(CNT)
1020 PC$=MID$(CNT$,2,5)
1030 GOTO 810
1040 PRINT "DATA OVERLAPS DISK-ILLEGAL"
1050 GOTO 1050
1060 PRINT "TOO MANY RECORDS TO SORT":STOP
1070 IF N>1750 THEN 1060
1080 LPRINT "TOTAL RECORDS ";N;" FREE MEMORY ";FRE(X)
1090 '
1100 M=N\          START OF SORT ROUTINE
1110 M=INT(M/2)
1120 EXH=0
1130 IF M=0 THEN 1280'    END OF SORT-GOTO OUTPUT ROUTINE
1140 K=N-M
1150 J=1
1160 I=J
1170 L=I+M
1180 IF B#(I)<=B#(L) THEN 1240
1190 SWAP B#(I),B#(L)
1200 SWAP BB(I),BB(L)
1210 EXH=EXH+1
1220 I=I-M
1230 IF I>=1 THEN 1170
1240 J=J+1
1250 IF J>K THEN PRINT "M = ";M;" SWAPS MADE = ";EXH:GOTO 1110
1260 GOTO 1160
1270 '
1280 LPRINT
1290 LPRINT "ENTERING OUTPUT ROUTINE TO DR 0"
1300 K=1
1310 A=1
1320 J=0
1330 J=J+1
1340 ZAP=BB(K)      ' THE ACTUAL DISK RECORD ADDRESS IN OLD FILE + 1000
1350 REC$=STR$(ZAP)
1360 I#=MID$(REC$,6,1)
1370 REC$=MID$(REC$,2,4)
1380 REC=VAL(REC$)
1390 REC=REC-1000
1400 X1=VAL(I$)
1410 I=X1 G=X1 Y=X1    ' I = THE BLOCKING FACTOR
1420 GET #1,REC
1430 FOR I=G TO Y
1440 FIELD #1, (I-1)*42 AS VREC$,42 AS VA$(I)
1450 DV$(J)=VA$(I)     ' BUILD THE OUTPUT RECORD FOR THE SORTED FILE
1460 NEXT I
1470 K=K+1
1480 IF K>N THEN 1590     ' N = THE NUMBER OF RECORDS IN THE MATRIX
1490 IF J=3 THEN 1500 ELSE 1330
1500 FOR L=1 TO 3
1510 FIELD #2, (L-1)*42 AS DF$,42 AS DP$(L)
1520 LSET DP$(L)=DV$(L)   ' TRANSFER DATA TO NEW FILES BUFFER
1530 NEXT L
1540 PUT #2,A                ' WRITE OUT THE NEW FILES RECORD
1550 A=A+1                   ' INCREMENT THE RECORD COUNTER FOR NEW FILE
1560 IF EFSW=2 THEN 1720  ' END OF FILE SWITCH FOR DRIVE 1
1570 IF EFSW=1 THEN 1690  ' END OF FILE SWITCH FOR DRIVE 0
```

```
1580 GOTO 1320
1590 EFSW=1
1600 IF J=3 THEN 1500
1610 EFSW=2
1620 J=J+1
1630 DV$(J)="EOF"    ' INSERT EOF FOR NEW FILE
1640 JS=J
1650 IF J=3 THEN 1500
1660 J=J+1
1670 DV$(J)=BLK$
1680 GOTO 1650
1690 J=1
1700 EFSW=2
1710 GOTO 1630
1720 A=A-1
1730 LPRINT "** EOF ** DR 0 IN OUTPUT SECTOR ";A;" RECORD # ";JS
1740 CLOSE 1,2
1750 '
1760 LPRINT
1770 LPRINT "ENTERING COPY-BACK ROUTINE"  ' COPY SORTED FILE TO ORIGINAL LOC
1780 OPEN "R",1,"LEDGER",0
1790 OPEN "R",2,"LEDGER",1
1800 REC=SREC
1810 EF$="EOF"
1820 J=S1
1830 A=1
1840 GET #1,A      ' GET NEW FILE ON DR 0
1850 FOR I=1 TO 3
1860 FIELD #1, (I-1)*42 AS D$,42 AS DREC$(I)
1870 DM$(I)=DREC$(I)
1880 IF MID$(DREC$(I),1,3)="EOF" THEN 2000
1890 NEXT I
1900 A=A+1
1910 IF GSW=1 THEN 2000
1920 GET #2,REC     GET OLD FILE ON DR 1 AND CHECK FOR FIRST BLOCK FOR START
1930 FOR I=1 TO 3
1940 FIELD #2, (I-1)*42 AS O$,42 AS ODEC$(I)
1950 R$(I)=ODEC$(I)
1960 NEXT I
1970 IF GSW=1 AND KC4 THEN 2050
1980 IF GSW=1 AND K03 THEN 2000
1990 GSW=1
2000 FOR K=1 TO 3
2010 R$(J)=DM$(K)   ' TRANSFER FILE DRIVE 0 TO FILE DRIVE 1
2020 IF MID$(DM$(K),1,3)="EOF" THEN 2200   ' IS IT END OF FILE DR 0
2030 J=J+1
2040 IF J=4 THEN 2070
2050 NEXT K
2060 GOTO 1840
2070 J=1
2080 FOR I=1 TO 3
2090 LSET ODEC$(I)=R$(I)  ' LOAD OUTPUT FILE DRIVE 1 BUFFER AREA
2100 NEXT I
2110 PUT #2,REC      ' WRITE OUT FILE TO DRIVE 1
2120 IF EFSW=1 THEN 2150   ' HAS EOF BEEN SENSED
2130 REC=REC+1        ' INCREMENT DRIVE 1 RECORD CONTER
2140 GOTO 1920
2150 LPRINT "DR 1 FIRST OUTPUT SECTOR ";SREC;" RECORD # ";S1
2160 LPRINT "** EOF ** DR 1 IN OUTPUT SECTOR ";REC;" RECORD # ";J
2170 LPRINT "EOJ"
2180 PRINT "EOJ"
2190 LOAD "GLMENU",0,R
2200 EFSW=1
2210 GOTO 2080
2220 END
```

Figure 32. SORTGL Program Listing

Program COPCON

A little simple utility program used for copying the BUDGET file to the Budget History File. I'm a firm believer in history files. It cost very little to keep the data once they are developed. And who knows what kind of information I can develop two or three years down the road from such hard-to-come-by information. It also serves as a very good means of backup.

```
10  ' PROGRAM NAME "COPCON"
20  ' PROGRAMMED BY      BUD SHAMBURGER     DECEMBER 1976
30  '
40  '
50  '
60  '
70  ' A PROGRAM TO COPY CONSECTIVE FILES ONLY.   IT WILL WORK WITH ONE
80  ' OR MORE DISK DRIVES
90  '
100 '*****************************************************************
110 '
120 CLEAR 1000
130 PRINT "COPY ** BASIC ** CONSECTIVE FILES **"
140 PRINT
150 INPUT "ENTER INPUT FILE NAME";INA$
160 INPUT "ENTER OUTPUT FILE NAME";OTNA$
170 INPUT "ENTER INPUT DR#";IDR
180 INPUT "ENTER OUTPUT DR#";ODR
190 PRINT "COPY "+INA$+" ON DR# ";IDR;" TO ";OTNA$;" ON DR# ";ODR+"?"
200 INPUT "ENTER -C- TOO CONTINUE";XC$
210 IF XC$<>"C" THEN 150
220 INPUT "TO MOUNT THE FILES ENTER -Y-";XY$
230 IF XY$<>"Y" THEN 260
240 IF IDR=ODR THEN UNLOAD IDR:MOUNT IDR:GOTO 260
250 UNLOAD IDR:ODR:MOUNT IDR,ODR
260 OPEN "I",1,INA$,IDR
270 OPEN "O",2,OTNA$,ODR
280 IEF=EOF(1)
290 IF IEF=-1 THEN 330
300 INPUT #1,A$
310 PRINT #2,A$
320 GOTO 280
330 CLOSE 1,2
340 PRINT "EOJ"
350 LOAD "GLMENU",0,R
360 END
```

Figure 33. COPCON Program Listing

Program CHART

Chart is a general ledger Chart of Accounts maintained on the disc in a program format. This program format makes for a simple method of maintaining and updating the Chart of Accounts.

```
CHART IS THE GENERAL LEDGER CHART OF ACCOUNTS MAINTAINED
ON THE DISK IN A PROGRAM FORMAT.  THIS MAKES FOR A SIMPLE
METHOD OF MAINTAINING AND UPDATING THE CHART


10  '            * * * C H A R T  O F  A C C O U N T S * * *
20  '
30  '
40  '
50  '
60  '
70  '       A S S E T S
80  '
90  '     CURRENT ASSETS
100 '  ACCT#
110 '  1101  CASH ON HAND-THIS IS THE AMOUNT OF CASH MAINTAINED
120 '                 IN THE CASH REGISTER AT ALL TIMES
130 '  1102  PETTY CASH  -THIS IS A MISC FUND USED FOR PAYING FOR
140 '                 INCIDENTIAL CASH ITEMS
150 '  1110  FIRST NATIONAL BANK - GENERAL-THIS IS THE GENERAL CHECKING
160 '                                 ACCOUNT USED FOR DEPOSITING
170 '                                 ALL RECEIPTS AND PAYING ALL
180 '                                 BILLS, EXCEPT PAYROLL
190 '  1111  FIRST NATIONAL BANK - PAYROLL-THIS IS THE BANK ACCOUNT USED
191 '                                 FOR PAYING ALL PAYROLLS
200 '  1112  FIRST NATIONAL BANK-SAVINGS ACCOUNT-PASS BOOK SAVINGS
210 '  1113  CASH DEPOSITS-MODERN SECURITY LIFE
240 '  1129  ACCOUNTS RECEIVABLE-CITY LEDGER-THIS ACCOUNTS REPRESENTS
250 '                                 ALL OF THE OUTSTANDING
260 '                                 CREDIT CARDS AND DIRECT
270 '                                 BILL ACCOUNTS WHICH HAVE
280 '                                 NOT BEEN COLLECTED EXCLUD-
290 '                                 ING THOSE ACCOUNTS STILL
300 '                                 REGISTERED.
310 '  1130  ACCOUNTS RECEIVABLE-REGULAR-THIS ACCOUNT REPRESENTS THE
320 '                                TOTAL AMOUNT  PENDING ON THOSE
330 '                                STILL REGISTERED
340 '  1133  PREPAID SERVICE CHARGE-THIS ACCOUNT REPRESENTS ANY PREPAID
350 '                              CHARGES NOT SPECIFICALLY COVERED
360 '                                ELSEWHERE
370 '  1134  PREPAID INSURANCE-HAZARD-REPRESENTS ONE FULL YEARS PREMIUM
380 '                              ON THE GENERAL PERIL INS  POLICY
390 '  1150  PREPAID INSURANCE-WORKMENS COMP-REPRESENTS ONE FULL YEARS
400 '                                 PREMIUM ON THE WORKMENS
410 '                                 COMP INS  POLICY
420 '
430 '     FIXED ASSETS
440 '  1201  BUILDING-MOTEL & RESTAURANT
450 '  1202  ACCUMULATED DEPRECIATION-BUILDINGS
460 '  1205  FURNITURE-MOTEL
470 '  1206  ACCUMULATED DEPRECIATION-FURNITURE-MOTEL
480 '  1207  OFFICE EQUIPMENT
490 '  1208  ACCUMULATED DEPRECIATION-OFFICE EQUIPMENT
500 '  1209  MOTEL EQUIPMENT
510 '  1210  ACCUMULATED DEPRECIATION-MOTEL EQUIPMENT
520 '  1211  SIGNS
530 '  1212  ACCUMULATED DEPRECIATION-SIGNS
540 '  1213  LAND IMPROVEMENTS
550 '  1214  ACCUMULATED DEPRECIATION-LAND IMPROVEMENTS
560 '  1215  HEATING & COOLING SYSTEM
570 '  1216  ACCUMULATED DEPRECIATION-HEATING & COOLING SYSTEM
580 '  1217  FENCE
590 '  1218  ACCUMULATED DEPRECIATION-FENCE
600 '
610 '     OTHER ASSETS
620 '
630 '  1301  RAMADA FRANCHISE
640 '  1302  ESCROW DEPOSIT
650 '  1303  UTILITY DEPOSITS
660 '  1304  ORGANIZATION COST
670 '
680 '     L I A B I L I T I E S
690 '
700 '     CURRENT LIABILITIES
710 '
720 '  2100  ACCOUNTS PAYABLE-REPRESENTS ALL DUE AND UNPAID ITEMS
730 '                          OTHERWISE UNALLOCATED
740 '  2109  STATE WITHHOLDING TAX PAYABLE-REPRESENTS ARK STATE WITH
750 '                                 HOLDING TAX FROM EMPLOYEES
760 '  2110  FEDERAL WITHHOLDING TAX PAYABLE-REPRESENTS FEDERAL WITH
770 '                                  HOLDING TAX FROM EMPLOYEES
780 '  2111  ACCRUED F. I. C. A.  TAXES PAYABLE-REPRESENTS FICA WITH
790 '                                 HOLDING TAX FROM EMPLOYEES
800 '  2133  NOTE PAYABLE-MODERN SECURITY LIFE-REPRESENTS 1ST MORTAGE
810 '                                    LOAN ON BUILDINGS AND
820 '                                    IMPROVEMENTS-CURRENT
830 '                                    YEARS PORTION ONLY
840 '  2134  DUE BOWENS RESTAURANT-REPRESENTS FUND COLLECTED ON BE-
850 '                             HALF OF BOWENS FROM MOTEL GUEST
860 '
870 '     NON-CURRENT LIABILITIES
880 '
890 '  2200  NOTE PAYABLE-MODERN SECURITY LIFE-REPRESENTS 1ST MORTAGE
900 '                                    LOAD ON BUILDING AND
910 '                                    IMPROVEMENTS-ALL BUT
920 '                                    CURRENTS YEARS PORTION
930 '
940 '     E Q U I T Y
950 '
960 '  3000  CAPITAL STOCK
970 '  3001  UNDISTRIBUTED TAXABLE INCOME
980 '  3096  CURRENT EARNINGS(LOSS)
990 '
1000 '      I N C O M E
1010 '
1020 '     ROOM-TELEPHONE-MEETING ROOM SALES
1030 '
1040 '  4100  ROOM SALES-REPRESENTS REVENUE RECEIVED FROM RENTAL OF
1050 '                        MOTEL ROOMS
1060 '  4101  MEETING ROOM SALES-REVENUE RECEIVED FROM RENTAL OF MEET-
1070 '                              ING ROOM RENTALS
1080 '  4102  TELEPHONE SALES-LONG DISTANCE-REVENUE RECEIVED FROM GUEST
1090 '                                    LONG DISTANCE CALLS
1100 '
1110 '      MISCELLANEOUS SALES
1120 '
1130 '  4200  TELEPHONE PAY STATION-REVENUE RECEIVED AS COMMISSIONS
1140 '                                 ON PAY STATIONS
1150 '  4201  RESTAURANT RENTAL-REVENUE RECEIVED FROM RESTAURANT LEASE
1160 '  4203  SERVICE STATION RENTAL-REVENUE RECEIVED FROM SERVICE
1170 '                                STATION LEASE
1180 '  4204  SALES TAX-NET OF SALES TAXES COLLECTED AND PAID
1190 '  4205  BOWEN RESTAURANT CREDIT CARD DISCOUNTS-REVENUE RECEIVED
1200 '                                AS DISCOUNTS ON CREDIT CARDS FROM
1210 '                                SALES COLLECTED ON BEHALF OF
1220 '                                BOWENS AND DEDUCTED FROM THEIR
1230 '                                PAYMENT
1240 '
1245 '  4206  INTEREST INCOME - INCOME FROM PASSBOOK  SAVINGS AND
1246 '                                TIME  DEPOSITS
1250 '  4207  MISC INCOME-MISE INCOME FROM OTHER SOURCES
1255 '     SALES-OTHER
1260 '
1270 '  4300  GAME MACHINE-REVENUE RECEIVED AS COMMISSION ON GAME MACH
1280 '  4301  GUEST LAUNDRY & VALET-REVENUE RECEIVED FROM GUEST FOR
1290 '                                FOR LAUNDRY & VALET SERVICE
1300 '  4302  MAGAZINE SALES-REVENUE RECEIVED FROM THE SALE OF MAGAZINE
1310 '  4303  CIGARETTE MACHINES-REVENUE RECEIVED AS COMMISSION FROM
1320 '                              CIGARETTE MACHINES
1330 '  4304  POP MACHINES-REVENUE RECEIVED FROM SALE OF POP
1340 '  4305  COPY MACHINE-REVENUE RECEIVED FROM SALE OF COPIES
1350 '  4306  CANDY-CONVENIENCE MACHINES-REVENUE RECEIVED FROM CANDY &
1360 '                                AND CONVENIENCE MACHINES AS
1370 '                                COMMISSIONS
1380 '
1390 '      E X P E N S E S
1400 '
1410 '     COST OF ROOM SALES
1420 '  7100  GENERAL MANAGER BONUS-FUNDS DRAWN BY OWNERS
1430 '  7101  NIGHT AUDITORS-PAYROLL-FUNDS PAID ALL FRONT DESK PERSONEL
1440 '                                AS SALARIES
1450 '  7102  HOUSEKEEPER-PAYROLL-FUNDS PAID HOUSEKEEPER AS SALARY
1460 '  7103  LINEN PERSONS-PAYROL-FUNDS PAID TO MAIDS HELPERS WHO
1461 '                        PRIMARILY TRANSPORT SOILED LINEN AND CLEAN
1462 '                       LINENS TO AND FROM LAUNDRY TO MAIDS CARTS
1463 '                                  BOYS AS SALARY
1470 '
1480 '  7104  MAIDS-PAYROLL-FUNDS PAID ALL MAIDS AS SALARY
1490 '  7105  LAUNDRY-PAYROLL-FUNDS PAID ALL LAUNDRY HELP AS SALARY
```

```
1500 '     7106  LINEN EXPENSE-COST OF ALL ROOM LINENS, SHEETS, PILLOW CASES
1510 '                 TOWEL, BATHMATS, FACE TOWELS ETC
1520 '     7107  GUEST SUPPLIES-COST OF ALL GUEST ROOM SUPPLIES, PAPER PRO-
1530 '                 DUCTS, SOAP, ASH TRAYS,  ETC
1540 '     7108  CLEANING SUPPLIES-COST OF ALL ROOM CLEANING SUPPLIES,
1550 '                 CHEMICALS, SPRAYS, SPOUNGES, TOLET SUPPLIE
1560 '                 ETC
1570 '     7109  LAUNDRY SUPPLIES-COST OF ALL SUPPLIES USED IN THE LAUNDRY
1580 '                 DETERGENT, BLEACH, SPOT REMOVER,  ETC
1590 '     7110  MISCELLANEOUS EXPENSE-ALL ROOM EXPENSES NOT ALLOCATED
1600 '     7111  PEST CONTROL-COST OF ROOM PEST CONTROL SPRAYING
1610 '     7112  TRAVEL AGENCY COMMISSIONS
1620 '     7113  UNIFORMS-COST OF LAUNDRY AND MAIDS UNIFORMS
1630 '     7114  GENERAL MANAGER-PAYROLL-COST OF GEN MGR PAYROLL.  IF ANY
1640 '     7115  BELLMEN PAYROLL-COST OF BELLMEN PAYROLL.  IF ANY
1650 '
1660 '         COST OF TELEPHONE SERVICE
1670 '
1680 '     7200  COST OF LONG DISTANCE SERVICE-LONG DISTANCE CHARGES MADE
1690 '                 BY ROOM GUEST
1700 '     7201  SWITCH BOARD RENTAL-COST OF SWITH BOARD RENT
1710 '     7202  MISCELLANEOUS-SALES TAX CHARGE, YELLOW PAGE ADV.  ETC
1720 '
1730 '         COST OF OTHER SALES
1740 '
1750 '     7300  GUEST LAUNDRY & VALET-COST OF PROVIDING SERVICE
1760 '     7301  MAGAZINES EXPENSE-COST OF MAGAZINES
1770 '     7302  POP MACHINES-COST OF POP SUPPLIES
1780 '     7303  MISCELLANEOUS EXP-ALL OTHER UNALLOCATED EXPENSES
1790 '     7304  COPY MACHINE EXP-COST OF COPY MACHINE RENTAL AND SUPPLIES
1800 '
1810 '         GENERAL AND ADMINISTRATIVE EXPENSE
1820 '
1830 '     7400  CREDIT CARD DISCOUNTS & BANK CHARGES
1840 '     7402  DUES & SUBSCRIPTIONS
1850 '     7403  LAND LEASE
1860 '     7404  MISCELLANEOUS
1870 '     7405  OFFICE SUPPLIES
1880 '     7406  POSTAGE
1890 '     7407  PROFESSIONAL SERVICES-COST OF CPA'S & LEGAL SERVICES
1900 '     7408  INTEREST EXPENSE
1910 '     7409  ROYALTY PAYMENTS-COST FOR RAMADA FRANCHISE ROYALTY PAYMENTS
1920 '     7410  TELEPHONE & TELEGRAPH- COST OF OFFICE TELEPHONE
1930 '     7411  TRAVEL-MOVING EXPENSE-COST OF AIRPORT SERVICE, GEN MGR TRVL
1940 '                 AND MAMAGEMENT MOVING EXPENSE
1950 '     7412  EMPLOYER FICA EXP & UNEMPLOYMENT INSURANCE EXP-COST OF
1960 '                 EMPLOYER PORTION OF FICA EXPENSE AND
1970 '                 PREMIUM ON UNEMPLOYMENT INS POLICY.
1980 '     7413  BAD DEBTS-UNCOLLECTED ROOM RENTS AND RETURNED CHECKS
1990 '     7414  FREIGHT & STORAGE-FREIGHT ON ALL GOODS SHIPPED TO PROPERTY
2000 '                 AND ANY LOCAL STORAGE COST
2010 '     7415  LONG & SHORT-NET ACCOUNT FOR MISCELLANEOUS OVER & SHORT
2020 '                 ERRORS IN NIGHT AUDITORS REPORTS
2030 '     7416  NCR MAINTANEOUS AGREEMENT-COST OF AGREEMENT ON CASH REG
2045 '     7417  RINA-TRAINING FEES
2047 '     7418  COMPUTER SERVICES-JDS
2048 '
2050 '         ADVERTISING AND PROMOTION
2060 '
2070 '     7500  MISCELLANEOUS-COST OF MISC ADV.  HELP WANTED ADDS ETC
2080 '     7501  NATIONAL ADVERTISING FUND-RAMADA NATIONAL ADV PROGRAM
2090 '     7502  NEWSPAPERS & MAGAZINES-LOCAL HIGH SCHOOLS AND COLLEGES
2100 '                 YEAR BOOKS ETC
2110 '     7503  BILLBOARDS-COST OF OUTDOOR ADV.  ALONG HIGHWAYS-OFFPREMISES
2120 '     7504  ON PREMISES SIGNS-COST OF LARGE RENTAL SIGNS ON PREMISES
2130 '
2140 '         REPAIRS AND MAINTENANCE
2150 '
2160 '     7600  CONTRACT LABOR-OTHER
2170 '     7601  CONTRACT LABOR-FAMILY (ROB)
2180 '     7602  PAYROLL-FAMILY (JIM)
2190 '     7603  AIR CONDITIONING & HEATING-COST OF MAINTAINING AND SERVICING
2200 '                 THESE UNITS INCLUDING CHEMICAL PRODUCTS
2210 '     7604  BUILDING-COST OF BUILDING REPAIRS
2220 '     7605  CONTRACT SERVICES-COST OF YEARLY SERVICE TO AIR CONDITIONING
2230 '                 AND HEATING UNIT-MAULDINS INC.
2240 '     7606  ELECTRICAL & MECHANICAL-COST OF REPAIRS AND SUPPLIES
2250 '     7607  FURNISHINGS-COST OF REPAIRS AND SUPPLIES
2260 '     7608  LAUNDRY-COST OF REPAIRS AND PARTS
2270 '     7609  MISCELLANEOUS-ALL UNALLOCATED COST
2280 '     7610  PAINTING & DECORATING
2290 '     7611  PLUMBING-COST OF REPAIRS AND PARTS
2300 '     7612  POOL- COST OF REPAIRS, PARTS, CHEMICALS AND SUPPLIES, ALL
2310 '     7613  T V LEASE-COST OF TV LEASE FROM RCA
2320 '     7614  T V  NON-CONTRACT-COST OF ALL T V REPAIRS
2330 '     7615  PAYROLL-OUTSIDE IF ANY
2335 '     7616  GROUNDS MAINTANENCE-LAWN & GROUNDS MAINT, SUPPLIES, EQUIP &
2340 '                 EQUIP REPAIRS
2350 '
2360 '         UTILITIES
2370 '
2380 '     7700  ELECTRICITY
2390 '     7701  NATURAL GAS
2400 '     7702  SEWER & GARBAGE
2410 '     7703  WATER
2420 '
2430 '         RESERVATION EXPENSE
2440 '
2450 '     7800  RESERVATION FEES-NET COST OF INBOUND FEES LESS OUTBOUND
2460 '                 RESERVATION CREDITS
2470 '     7801  RAMADA INFO2000 TERMINAL-COST OF TERMINAL RENTAL
2480 '
2490 '         INSURANCE-TAXES-DEPRECIATION
2500 '
2510 '     7900  WORKMENS COMPENSATION INSURANCE POLICY
2520 '     7901  GENERAL PERILS INSURANCE POLICY
2530 '     7902  PROPERTY TAXES
2540 '     7903  DEPRECIATION EXPENSE
2550 '     7904  MORTAGE INSURANCE POLICY(MODERN SECURITY LIFE)
```

Figure 34. CHART Program Listing

Program GENPRO

This is the system boot program. I've included it so you may modify it to suit your own needs and to add your own programs to it. It makes running and maintaining your general ledger system a snap.

```
10 ' PROGRAM NAME  "GENPRO"
20 ' PROGRAMMED BY:          BUD SHAMBURGER     JANUARY 1977
30 '
40 '
50 '
60 ' A PROGRAM TO PRINT THE PROCEDURES FOR USING THE GENERAL LEDGER
70 ' PACKAGE
80 '
90 '*****************************************************************
100 '
110 LPRINT "                GENERAL LEDGER PROCEDURE"
120 LPRINT
130 LPRINT "   MONTHLY"
140 LPRINT
150 LPRINT "PROGRAM  STEP          PROCEDURE"
160 LPRINT
170 LPRINT "GL6        1     ENTER DAILY ROOM REVENUE JOURNAL VOUCHERS"
180 LPRINT "                 TO GENERAL LEDGER MASTER FILE(ENTER DONE AT END"
190 LPRINT "GL1        2     ENTER CHECK TRANSACTIONS FOR ACCOUNT NUMBER 1110"
200 LPRINT "                 -THE GENERAL CHECKING ACCOUNT-"
210 LPRINT "GL1        3     ENTER JOURNAL VOUCHERS FOR:"
220 LPRINT "                 A  OTHER INCOME(CONCESSIONS,  RENT ETC)"
230 LPRINT "                 B  BANK CHARGES(RETURNED CHECKS,  BAC & MC ETC)"
240 LPRINT "                 C  ADD NEW ACCOUNT HEADERS(ZERO MONEY AMOUNTS)"
250 LPRINT "COPRAN     4     COPY 'LEDGER' CURRENT TO 'LEDGER' BACKUP-BEFORE"
260 LPRINT "SORTGL     5     SORT ON CHECK NUMBER/VOUCHER NUMBER"
270 LPRINT "GL2        6     RUN CHECK/VOUCHER REGISTER-VERIFY DEBITS=CREDITS"
280 LPRINT "COPRAN     7     COPY 'BANKCURR' TO 'BANKBKUP'"
290 LPRINT "GL3        8     MERGE-DRIVE 1 BANKBKUP- WITH -DRIVE 0 LEDGER"
300 LPRINT "                 ACCOUNT 1110- AND CUT NEW -DRIVE 1 BANKCURR-"
310 LPRINT "COPRAN     9     COPY 'BANKCURR'(0201-0400) TO 'BANKSAVE'(0401-0600)"
320 LPRINT "GL4       10     ENTER CHECK NUMBER AND AMOUNT FROM CANCELED"
330 LPRINT "                 CHECKS AND TAG CHECKS CASHED IN 'BANKCURR'"
340 LPRINT "                 (ENTER 'T' TO TERMINATE INPUT)"
350 LPRINT "GL5       11     RUN BANK STATEMENT FOR ACCOUNT 1110 AND BALANCE"
360 LPRINT "COPRAN           TO BANK.  MAKE ANY CORRECTIONS TO 'LEDGER' & "
370 LPRINT "                 COPY TO 'LEDGER' BACKUP-BEFORE."
380 LPRINT "SORTGL    12     SORT 'LEDGER' ON ACCT#/CHECK#/VOUCHER#"
390 LPRINT "GL2       13     RUN GENERAL JOURNAL.  VERIFY BANK BALANCES.  LOOK"
400 LPRINT "                 OVER RUN FOR ERRORS.  CORRECT ANY ERRORS"
410 LPRINT "                 AND RE-RUN IF NECESSARY"
420 LPRINT "GL2       14     RUN BALANCE SHEET & OPERATING STATEMENT"
430 LPRINT "GL7       15     RUN MONTHLY BUDGET"
440 LPRINT "GL7       16     RUN Y T D  BUDGET"
450 LPRINT "GL7       17     RUN MONTHLY STATISTICAL REPORT"
460 LPRINT "GL7       18     RUN Y T D  STATISTICAL REPORT"
470 LPRINT "COPRAN    19   COPY 'LEDGER' CURRENT TO 'LEDGER' BACKUP-AFTER"
480 LPRINT "COPCON    20     COPY 'BUDGET' TO 'BGTMOYR'"
490 LPRINT
500 LPRINT "    YEAR END PROCEDURE"
510 LPRINT
520 LPRINT "GL2        1     AFTER ALL ENTRIES AND RUNS FOR THE YEAR HAVE"
530 LPRINT "                 HAVE BEEN MADE.  REQUEST CLOSING ENTRIES.  PLACE"
540 LPRINT "                 NEW FLOPY ON DRIVE 0 AND RUN GENERAL JOURNAL""
550 LPRINT "                 WITH NO TRANSACTIONS.  ALL THE PROPER ACCOUNTS"
560 LPRINT "                 WILL BE ZEROED OUT."
570 LPRINT "                 MANUALLY ADD CURRENT EARNINGS TOTAL(ACCOUNT"
580 LPRINT "                 # 3096 TO UNDISTRIBUTED TAXABLE INCOME(ACCOUNT"
590 LPRINT "                 # 3001 TO PLACE THE BALANCE SHEET BACK IN BALANCE"
600 LPRINT "           2     ENTER NEW BUDGET FIGURES INTO DATA TABLES IN"
610 LPRINT "                 PROGRAM 'GL7'  "
620 LPRINT "           3     MAKE JOURNAL ENTRY TO ESTABLISH NEW CURRENT"
630 LPRINT "                 LIABILITIES-NOTES PAYABLE ACCOUNT 2133. "
640 LPRINT "           4     ACCRUE ACCOUNTS PAYABLE AT YEAR END AND "
650 LPRINT "                 JOURNALIZE.  TAKE OUT OF ACCOUNTS PAYABLE AS"
660 LPRINT "                 PAID. "
670 LOAD "GLMENU",0,R
680 END
```

Figure 35. GENPRO Program Listing

CONCLUSION

The run procedures are just straight forward as the Summary of Procedures (INTERFACE AGE, October Issue, page 65) indicates. I always have them in front of me when I attempt any job. It's too easy to forget a step. Forget a step and there goes much valuable time and sometimes much data. So stick to the procedures and you will have fewer problems. You will notice I am a stickler for backing up files. That's because I've learned the hard way. Better too much back-up than not enough. I back up my files both before and after running the ledger. Then I can completely reconstruct at any point in time if things bomb out. Mine have. Let's not talk about that. Use the flow charts shown in both Part 1 and Part 2 (INTERFACE AGE, September and October Issues) along with the procedures until you have a visual picture of just what's taking place. Until you know just how all the program and jobs dovetail together, continue to use the procedures.

"I've got to hand it to you, Hodgekiss, I never believed you'd get 10 megabytes of data on a frisbee."

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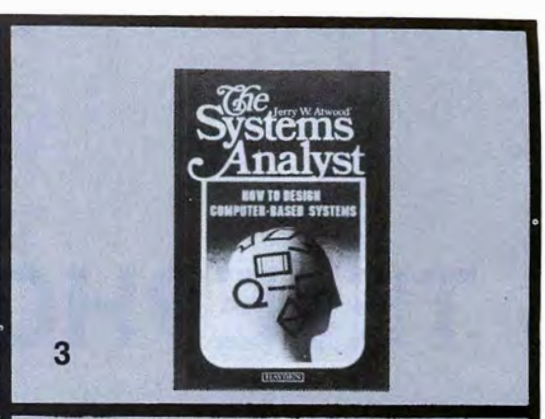

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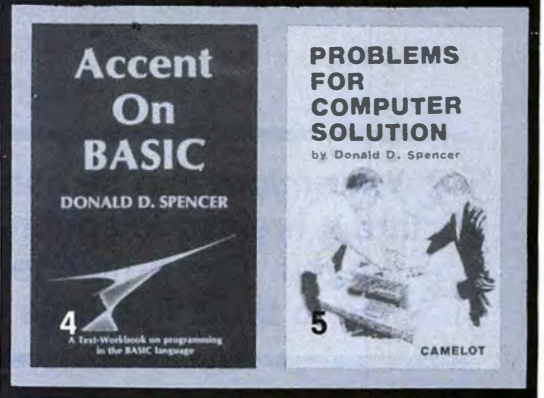

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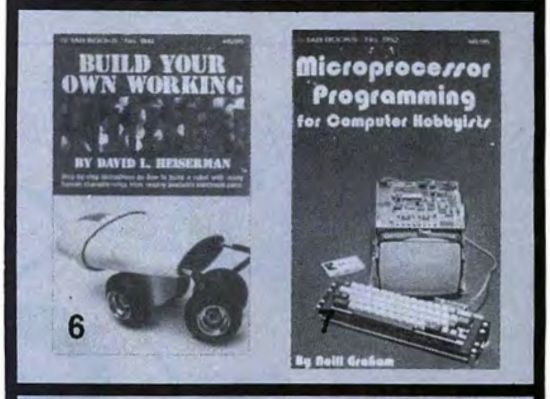

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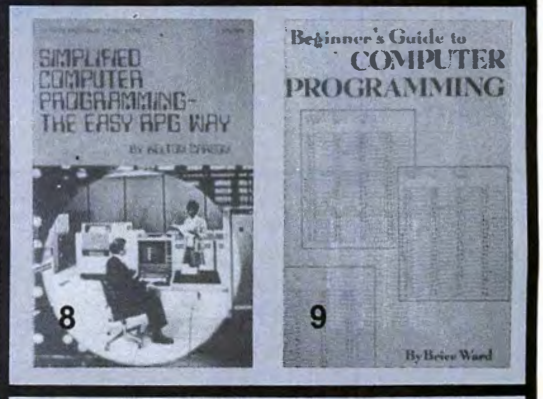

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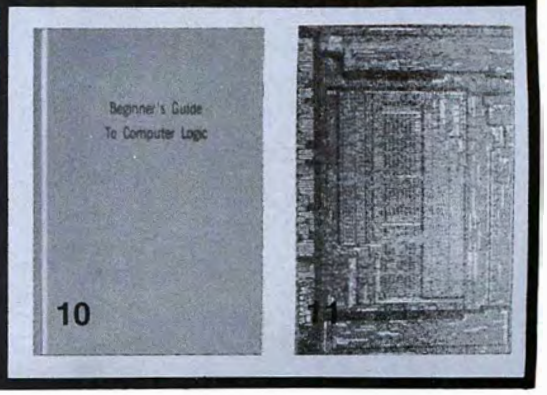

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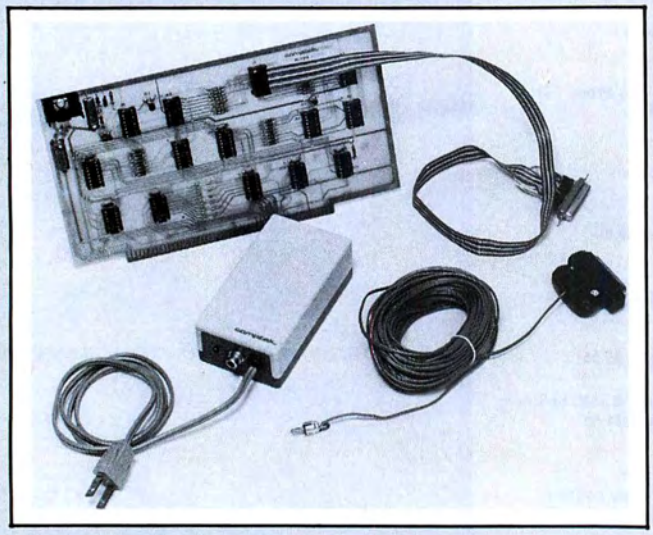
HARDWARE

TELEPHONE-ASSOCIATED

By Roger H. Edelson,

Your micro can be converted into a tireless telephone dialer for you. This article tells you how to build this little helper.



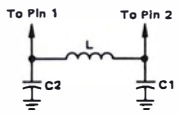
Wouldn't it be nice if you could just type the name of a friend, or an often-called supplier, or your home, on your keyboard and immediately your computer would dial that phone number? It would also be nice if the computer would re-dial if there was a busy signal or the line did not connect. Such a capability is possible with some off-the-shelf integrated circuits.

Motorola's IC's the MC14408/14409 provide a method for taking a parallel binary or BCD input and producing a number of serial output pulses corresponding to the value of the input number. The output pulses are compatible with telephone dialing equipment and various choices of dialing constants are available by appropriate selection of the control inputs.

Figure 1. Component Selection for Oscillator/Clock Frequency.

$f_{Clk} = \frac{7.118}{\sqrt{LC}}$ where f_{Clk} in kHz, L in mH, C = C1 = C2 in μF

$\%f_{Clk} = -0.5\,[\%C + \%L] \pm 3.0$ where $\%f_{Clk}$, %C, %L are the frequency capacitor, and inductor tolerances in percent. The ±3.0% accounts for supply voltage and ambient temperature variations.



EXAMPLE

L	%L	C=C1=C2	%C	f_{Clk}	$\%f_{Clk}$	OUTPULSING RATE $f_{OPL} = f_{Clk}/1.6$
5.0 mH	±5.0	0.04 μF	±5.0	≈16 kHz	±8.0	≈10 pps
5.0 mH	±5.0	0.01 μF	±5.0	≈32 kHz	±8.0	≈20 pps

The MC14408/14409 can also be driven by the Motorola MC14419 2-of-8 keypad-to-binary code converter to allow also manual dialing. The MC14408 has been conveniently partitioned to allow for the inclusion of additional RAM and controls to provide storage of a repertoire of phone numbers. The only difference between the MC14408 and the MC14409 is the action of the DRO (Dial Rotating Output). In the MC14408 the DRO line remains high during the continuous outpulsing of all digits, and in the MC14409, the DRO line goes low between each digit-pulse-burst.

Let's look at the features provided by the MC14408/9:

1) An on-chip oscillator is provided: to get a 10 pps dialing rate. The frequency must be set to 16 kHz; 32 kHz gives a 20 pps rate. See Figure 1 for the required component selection to give the desired output frequency.
2) All inputs are diode-protected against overvoltage.
3) Memory is sufficient to store numbers up to 16 digits long.
4) Memory storage by FIFO (First-In-First-Out) register of telephone digits, a single pin command of Re-Dialing function of last dialed number.
5) A Hold Interrupt Control to provide additional

REPORT

INTEGRATED CIRCUITS

Hardware Editor

length interdigit delays when required — such as a wait for intermediate dial tones.

6) Selectable dial-pulsing rate: 10 or 20 pulses per second (pps).
7) Selectable interdigit time (300 or 800 ms. when using a 10 pps rate, and 150 or 400 ms. with a 20 pps rate).
8) The make break ratio is selectable at either 61% or 67%.
9) The outputs are buffered and are compatible with either a discrete transistor interface or TTL interfaces. The outputs will drive either one Schottky TTL load or two low-power TTL loads.
10) Low power dissipation — about 470 μamp at 5V. (F_{osc} = 16 kHz).

This installation is not power-greedy. Power dissipation is about 470 μamp at 5V.

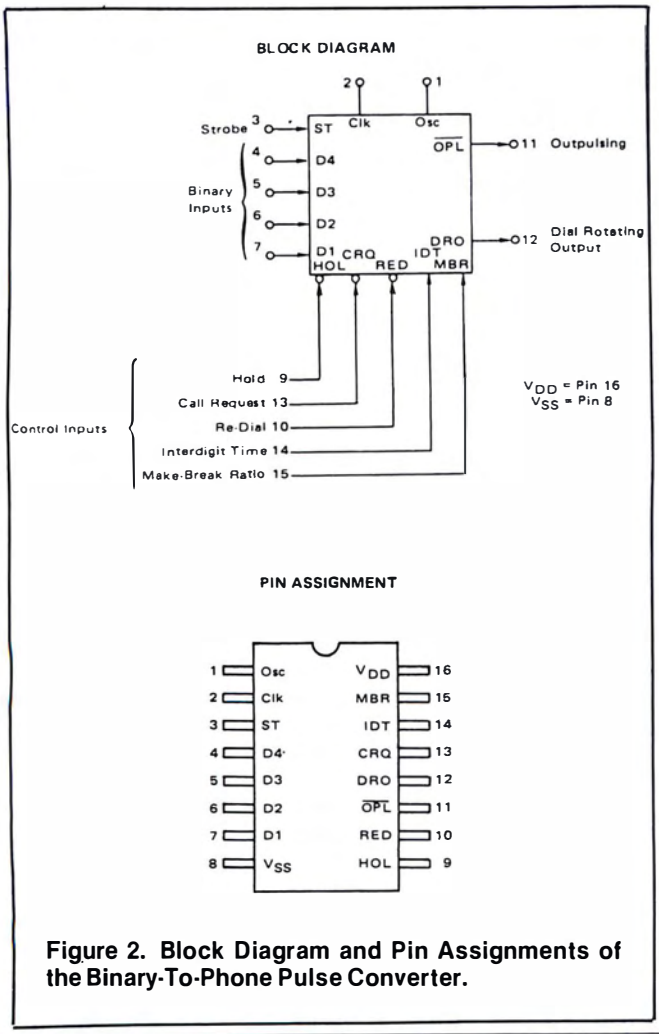


Figure 2. Block Diagram and Pin Assignments of the Binary-To-Phone Pulse Converter.

Figure 3. Timing Diagram — Data and Strobe Inputs

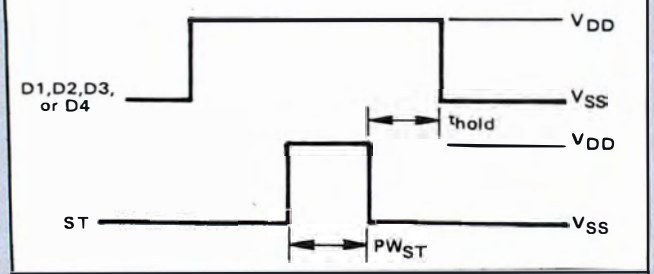
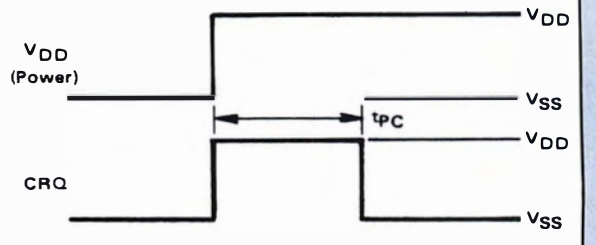


Figure 4. Timing Diagram — Call Request



If power is turned off after each call, CRQ must stay high after power is applied (for a duration of t_{PC}) to ensure no spurious outpulsing. For this use the redial function is invalid.

The block diagram and pin assignments of the Binary-To-Phone Pulse Converter is shown in Figure 2.

Referring to the block diagram let's take a look at the device operation. The chip has a built-in oscillator which is tuned to the desired frequency by an L-C pi network applied between pins 1 and 2. This network and the appropriate values is shown in Figure 1. If desired, an external clock source may be connected to pin 1, the levels should be TTL compatible. Pin 3 is the Strobe Input; a positive going pulse applied to this pin indicates that valid data are applied to the Data Inputs. *The first*

The chip does not provide indication of FIFO-FULL. The computer programming must handle this function.

strobe pulse after a call is requested (CRQ is low) will clear the internal FIFO memory and enter the 4-bit number into the FIFO. Successive strobe pulses will store up to a maximum of 16 digits in the FIFO which will then ignore all subsequent digits until a new call is requested. The chip does not provide an indication when the FIFO is full, therefore the computer programming must handle this function. The timing of the strobe pulse to data inputs (DIs) and CRQ input is shown in Figures 3 and 4. The switching characteristics are given in Table 1. Some of the times are given as functions of the clock frequency and are therefore dependent upon the chosen outpulsing rate.

Pins 4, 5, 6, and 7 are the Data Input pins, D4, D3, D2, and D1 respectively. A 4-bit binary coded digit entered on these pins will result in an equivalent number of output pulses. The only exception is for code 0000 (0 in decimal) which when entered will result in the outpulsing of ten pulses.

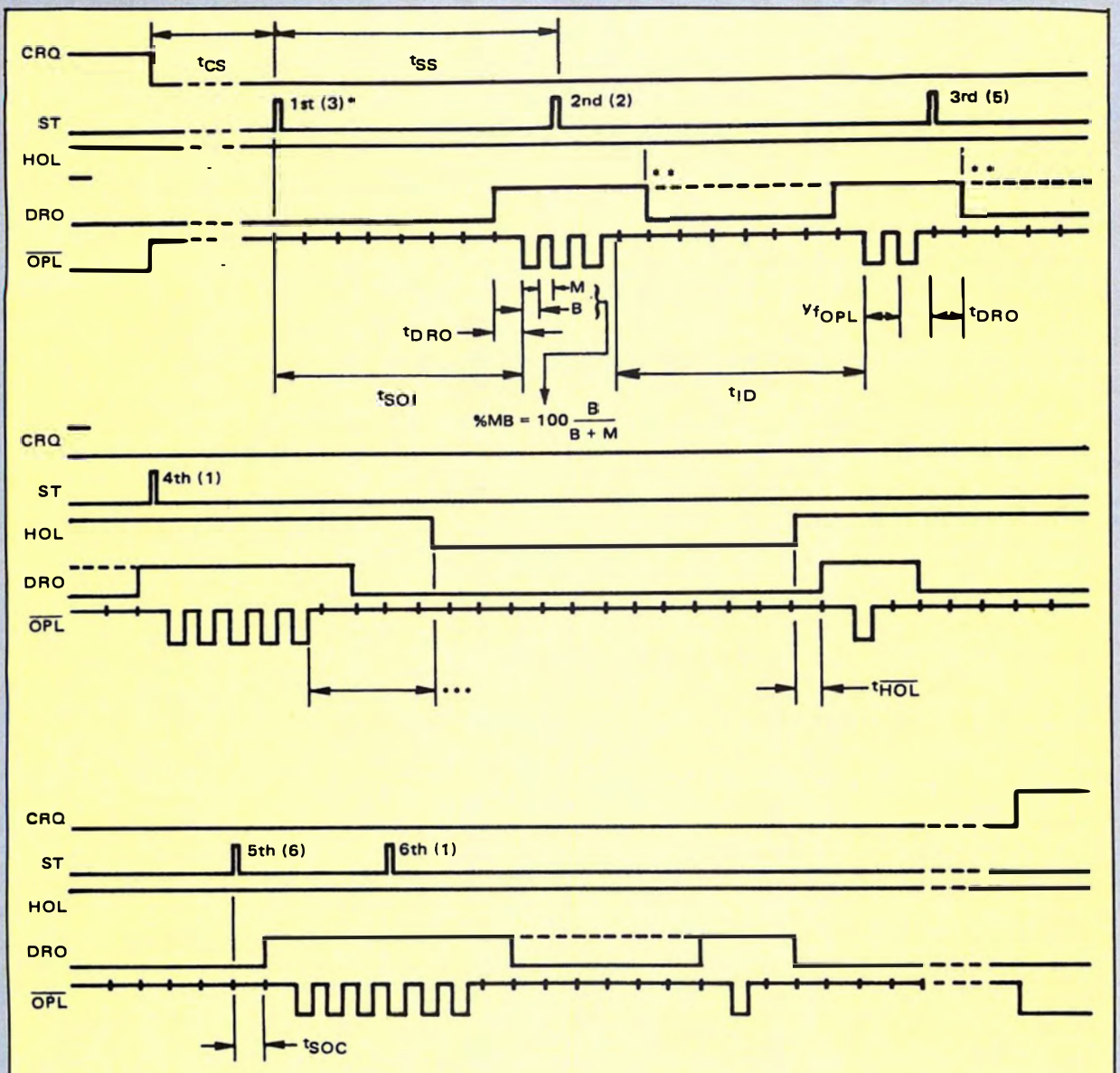
INPUTS						OUTPUTS	
$\overline{CRQ}$	D4 D3 D2 D1	ST	$\overline{RED}$	$\overline{HOL}$	IDT	MBR	$\overline{OPL}$	DRO †
1	X X X X	X	X	X	X	X	0	0
0	X X X X	0	1	1	X	X	1 (Steady State)	0 (Steady State)
0	X X X X (nth Digit)	⊓	1	1	X	X	Number of pulses (⊓) of nth digit = binary combination of D4, D3, D2, D1.*	1 During outpulsing 0 Otherwise
0	X X X X	0	⊔	1	X	X	Digits of number in memory re-sent.	1 During outpulsing 0 Otherwise
0	X X X X	X	1	0	X	X	1 After conclusion of digit being outpulsed.	0 After conclusion of digit being outpulsed
X	X X X X	X	X	X	0 1	X	300 ms Interdigit time 800 ms Interdigit time	f_{Clk} = 16 kHz
X	X X X X	X	X	X	X	0 1	61% (≈1.6:1) Make-Break Ratio 67% (≈2:1) Make-Break Ratio	

X = Don't Care

* With the exception of 0000 which will give 10 pulses.

† Refer to timing diagram Figure 10.

Figure 6. Truth Table



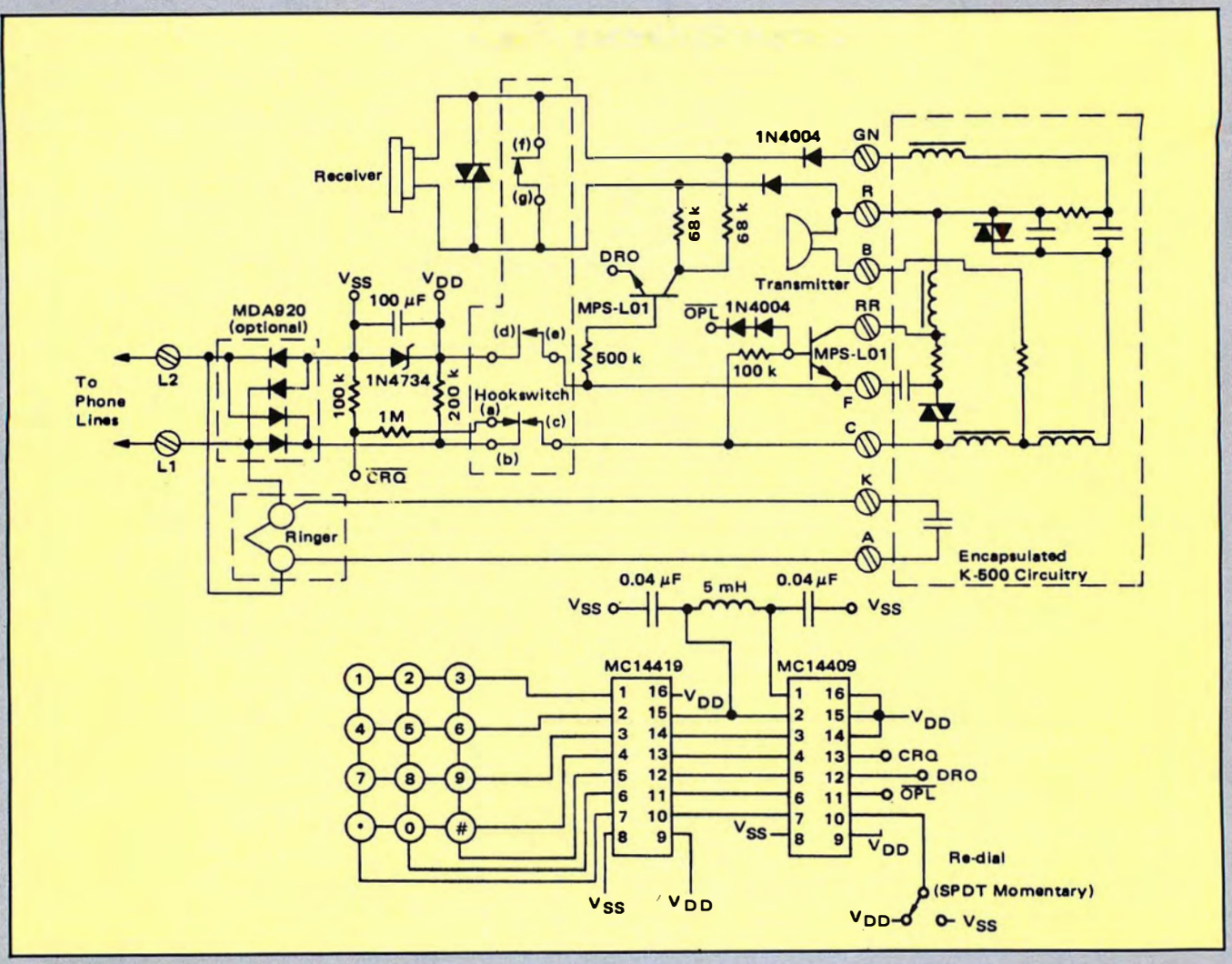
Notes:

(*) 1st, 2nd, 3rd, etc., denotes Strobe pulse sequence – i.e., which digit in the phone number is being dialed. The number in parentheses denotes the numerical value of the digit being dialed. The examples define the various voltage – level and timing requirements, not a complete phone number.

(**) For the MC14408 the DRO signal will remain high provided digits remain in the memory, or a digit for continuing outpulsing is strobed in before the anticipated falling edge of the most significant digit in the memory. (i.e., [200-% MB] ms after the most significant outpulsing edge).

(***) For the HOL signal to hold a next digit (e.g. the 4th, etc.,) the HOL falling edge must not appear after [t_{ID}-%MB + 100] ms the last outpulsing edge of the previous digit.

Figure 5. Dial Rotating Output for the MC14409


Receiver
(f)
(g)
1N4004
GN
R
B
68 k
68 k
DRO
Transmitter
MDA920
(optional)
VSS
VDD
100 µF
MPS-L01
OPL
1N4004
RR
(d)
(e)
500 k
100 k
MPS-L01
To
Phone
Lines
L2
L1
100 k
1N4734
200 k
Hookswitch
(a)
(c)
1M
(b)
F
C
CRQ
K
Ringer
A
Encapsulated
K-500 Circuitry
0.04 µF
5 mH
0.04 µF
VSS
VSS
MC14419
MC14409
1 2 3
4 5 6
7 8 9
• 0 #
1 16
2 15
3 14
4 13
5 12
6 11
7 10
8 9
VDD
VDD
CRQ
DRO
OPL
VSS
VDD
Re-dial
(SPDT Momentary)
VDD
VSS
VSS
VDD

System ground is tied to the chip at pin 8.

Pin 9 is the Hold function input. When this line is taken low the chip will stop outpulsing after completion of the present digit being dialed. This function provides for increased interdigit times which are necessary when multi-dial-tone phones are being used; i.e. when it is necessary to wait for the outside line after dialing an access digit like "8" or "9" in some systems.

Discrete transistor interfaces have been used and the transistor types are not critical.

A very nice feature of the chip is enabled when pin 10 (Re-Dial) is taken low. When this function is enabled, the chip automatically outpulses the digits stored in memory after the last time a call was requested. This function can be used over and over. It would be nice if the computer could detect a busy signal or a non-ringing condition and automatically select the Re-Dial function.

Pin 11 is the chip output — $\overline{OPL}$. Pulses are outputted from this pin in bursts corresponding to the digits of the telephone number being dialed. The duty cycle (make-to-break ratio and the interdigit time are selectable as noted before). As pointed out earlier the output is either TTL or discrete transistor compatible.

The Dial Rotating Output (DRO, pin 12) is the only difference between the MC14408 and the MC14409. In the MC14408 the DRO line goes high at the beginning of the first digit pulse burst and remains high throughout the entire dialed phone number. In the MC14409 the DRO line goes high at the beginning of a pulse burst but falls low at the end of each digit pulse burst — see the timing diagram of Figure 5. Note that when the Hold command is used DRO will go low at the end of the digit pulse burst being outpulsed when the Hold line is activated.

The CRQ (Call Request) line is used to clear the FIFO memory and to prepare the chip to either accept new digits to be dialed, or to re-dial an already stored number. CRQ must be taken low to initiate a new call.

The interdigit timing is selectable as noted in the list of features; the timing selection is done through the IDT line, pin 14. The MBR (Make-Break-Ratio) selection is provided on pin 15. When the MBR line is high a 67% low, 33% high duty cycle is selected, and when this line is low the ratio is 61% to 39%. Figure 6 gives a truth table for the selection of the various functions and timing characteristics.

Pin 16 is the connection for the positive power supply.

The chip is very easy to use being not too critical of timing. Figure 7 shows MC14409 connected to a K500 telephone. Discrete transistor interfaces have been used and the transistor types are not critical. The circuit also indicates the use of an MC14419 to provide manual dialing. To use this circuit with a computer an output port would take the place of the MC14419 and the computer would provide the strobe pulse. There would be no need to time the clock back to the computer to eliminate switch bounce. If both computer and manual dialing functions are desired switching must be provided to allow selection of either the MC14419 or the computer output port.

A block diagram of the MC14419 is shown in Figure 8. This device functions as a 16-keypad to binary-coded-decimal encoder. The entry must be made from a 4 x 4 matrix as the device contains a 2 of 8 encoder which reads the keypads. In order to get an output from the four data lines one, and only one, row along with one, and only one, column must be activated. Any other com-

Figure 8. Block Diagram of the 14419

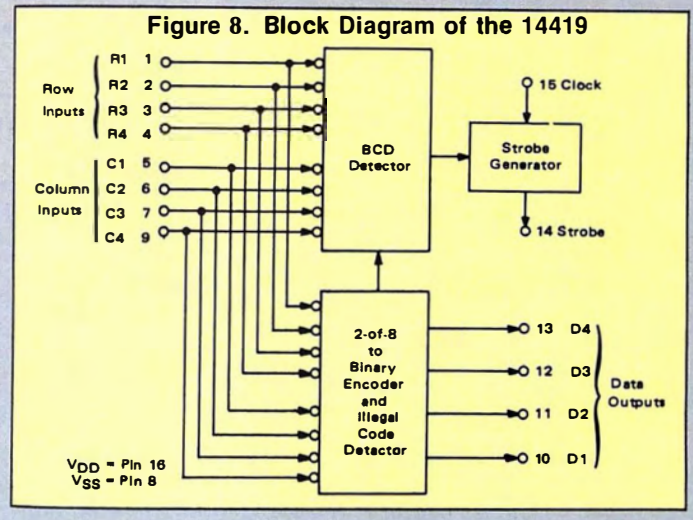
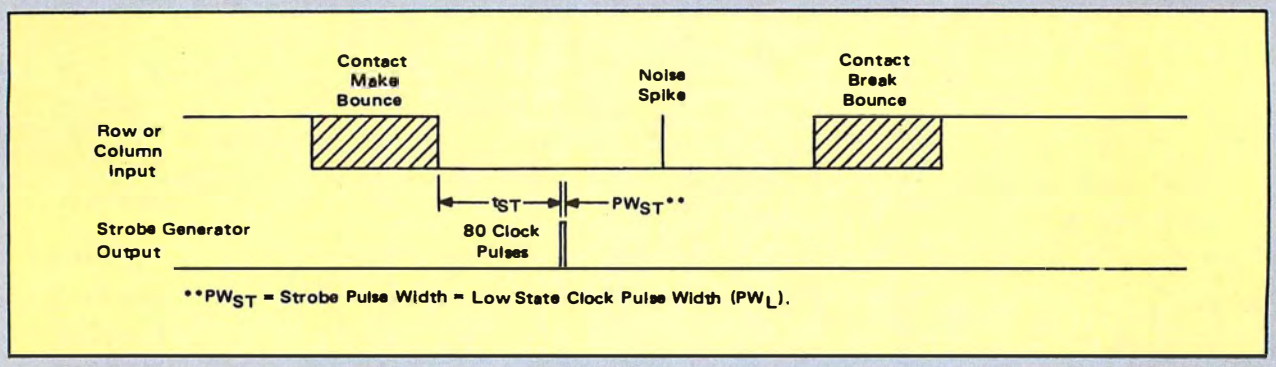


Figure 9. Truth Table

Key**	Inputs: Row R4	R3	R2	R1	Inputs: Column C4	C3	C2	C1	Outputs D4	D3	D2	D1	Strobe
1	1	1	1	0	1	1	1	0	0	0	0	1	⎍
2	1	1	1	0	1	1	0	1	0	0	1	0	⎍
3	1	1	1	0	1	0	1	1	0	0	1	1	⎍
A	1	1	1	0	0	1	1	1	1	1	0	0	0
4	1	1	0	1	1	1	1	0	0	1	0	0	⎍
5	1	1	0	1	1	1	0	1	0	1	0	1	⎍
6	1	1	0	1	1	0	1	1	0	1	1	0	⎍
B	1	1	0	1	0	1	1	1	1	1	0	1	0
7	1	0	1	1	1	1	1	0	0	1	1	1	⎍
8	1	0	1	1	1	1	0	1	1	0	0	0	⎍
9	1	0	1	1	1	0	1	1	1	0	0	1	⎍
C	1	0	1	1	0	1	1	1	1	1	1	0	0
*	0	1	1	1	1	1	1	0	1	0	1	0	0
0	0	1	1	1	1	1	0	1	0	0	0	0	⎍
#	0	1	1	1	1	0	1	1	1	0	1	1	0
D	0	1	1	1	0	1	1	1	1	1	1	1	0
	All Other Combinations								0	0	0	0	0

**See Figure 4 for keypad designation.

Figure 10. Strobe Generator Timing Diagram



bination of inputs will result in an all zeroes output alone with no strobe pulse. A strobe pulse is only output for the ten decimal numbers — * and # will produce correct data outputs but no strobe. See the Truth Table in Figure 9.

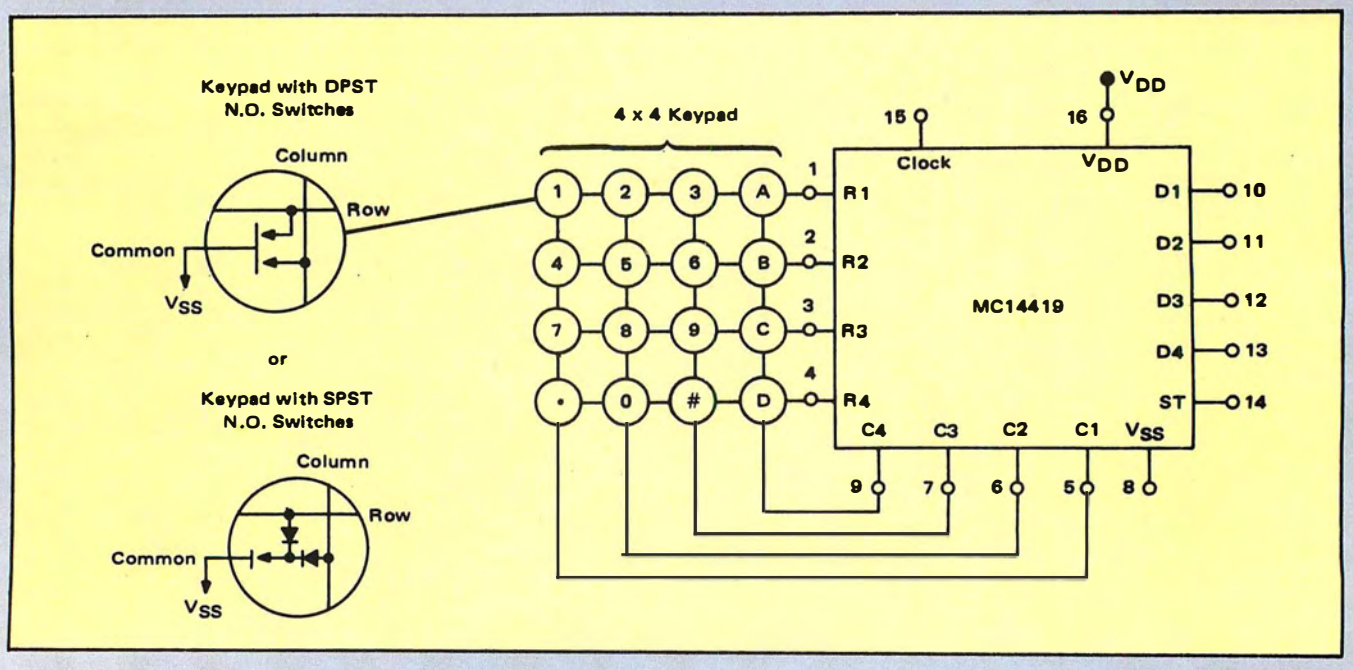
One nice feature of the MC14419 is the internal debounce circuitry that is provided. The chip is arranged such that the two and column input lines must remain in a stable and allowable configuration for at least 80 clock pulses after activation. Once the contact bounce has settled and 80 clock pulses have occurred, the chip will produce one, and only one, strobe pulse. The timing, shown in Figure 10, is adjusted such that noise spikes and contact break bounce will not cause the chip to produce another strobe pulse.

The MC14419 provides internal pull-up resistors for the row and column inputs. Figure 11 shows how the chip may be connected to either DPST Normally Open, or SPST Normally Open keypad switches.

The MC14419 is compatible with Low Power TTL logic and typically requires only 5 μamp in the standby mode with a 5V supply.

These two chips, the MC14409/08 and the MC14419 combined with a Quad 2-to-1 line data multiplexer will provide an easy way to mechanize a computer-controlled dialing function with a manual alternate. Programming will have to be provided to insure that the number of digits (16) is not exceeded and that the time between the outputting of successive digits by the computer is not faster than the chip can handle. Also some form of tone detection, probably a phase-locked loop, will be necessary to detect a busy signal or a multi-level dialtone when outside line access codes are used. The chips themselves are inexpensive; approximately $7.00 for the plastic and $9.00 for the ceramic version in 100-up quantities.

Figure 11. Typical Keypad Interface Application



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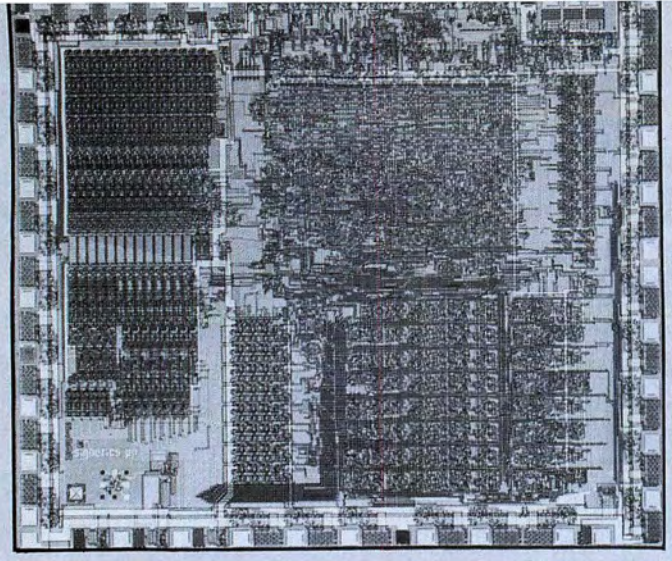


INTERFACE DESIGN WITH

by Alex Goldberger
Signetics, Sunnyvale, California

Interfacing a microprocessor to peripheral devices is an important part of a total microcomputer system design. The characteristics of the interface depend to a large extent on total system requirements and other factors such as CPU loading and data speed. The use of interrupts and/or DMA structures also have an impact on the system input/output structure. The design of an I/O interface is not limited to hardware, and hardware/software trade-offs must be considered.

This article examines the use of the 2650's set of I/O instructions and the interface between the 2650 and I/O ports. Interrupt and DMA-controlled I/O are not discussed. A number of application examples for both serial and parallel I/O are given. Several types of input, output, and bidirectional interface devices are also examined.

BASIC I/O STRUCTURE

The 2650 is equipped with input and output facilities which can perform both single bit input/output and 8-bit parallel input/output.

The single bit input and output, called Sense (pin 1) and Flag (pin 40), are associated with the Program Status Word Upper (PSWU). The Flag output always reflects the value of bit 6 of the PSWU, while bit 7 of the PSWU always reflects the value of the Sense input signal. The Sense and Flag signals can be monitored and controlled with the PSW instructions.

Parallel I/O can be accomplished using the extended or non-extended read and write instructions. The extended and non-extended types are distinguished by the state of the E/$\overline{NE}$ output of the microprocessor.

The non-extended I/O instructions are single-byte instructions which accomplish a 1-byte data transfer into or out of the 2650. They also control the state of the D/$\overline{C}$ output, which can be used as a 1-bit device address in small systems.

The extended I/O instructions are 2-byte instructions. When executing extended I/O instructions, the second byte of the instruction is output on the lower 8 bits of the address bus (ADRO-ADR7). This information is normally used as an I/O device address to select 1 of up to 256 input or output devices, but may also be used to output control or status signals.

Parallel I/O operations may use any CPU register as the data source or destination. This offers significant flexibility in writing I/O software, because there is not a single accumulator register to create a "bottle-neck" in the data flow. The functional block diagram in Figure 1 illustrates the various I/O facilities.

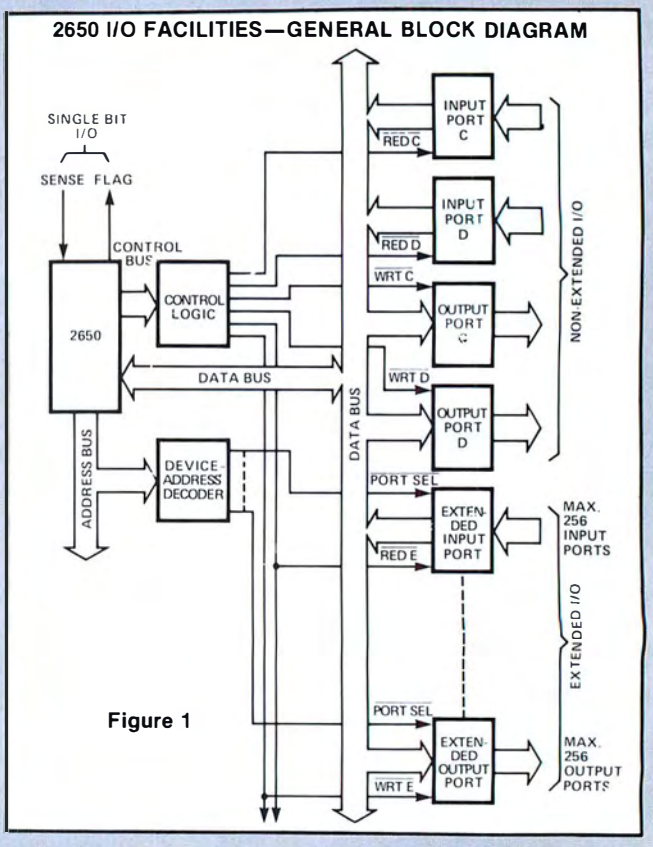


Figure 1

I/O AS PART OF THE MEMORY ADDRESS SPACE

The 2650 user may choose to transfer data into or out of the processor using the memory control signals. The advantage of this technique is that the data can be read or written by the program with memory load and store instructions, and data may be directly operated upon with

SIGNETICS 2650

logical and arithmetic instructions. The memory referencing instructions can take advantage of the flexible addressing modes provided by the system, such as indexing and indirect addressing. A possible disadvantage of this method is that it may be necessary to decode more address lines to determine the device address than with the other I/O facilities.

To make use of this technique, the designer must assign memory addresses to I/O devices and design the device interfaces to respond to the same signals as memory.

I/O INTERFACE SIGNALS

Table 1 summarizes the state of the 2650 I/O interface signals for the various methods of I/O which are available.

SENSE INPUT AND FLAG OUTPUT

One of the I/O capabilities of the 2650 is provided by the sense input and flag output. The sense and flag pins may be used for single-bit input or output of status or control information. They can also be used to implement a serial data communications channel. Two examples of this application are give below.

ASYNCHRONOUS SERIAL COMMUNICATIONS PORT: In applications where a serial type of terminal (like a teletypewriter) must be connected to the microcomputer systems, the sense pin and flag pin can be used to interface with the terminal. The basic character format for asynchronous serial I/O is shown in Figure 2.

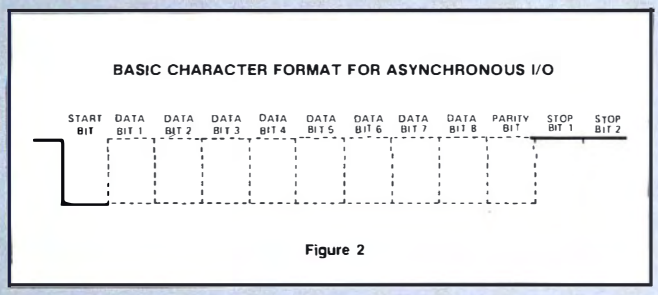


Figure 2

A number of parameters of this character format, and the transmission speed, is different for various types of terminals. The variable parameters are:

Baud rate (bits per second): 110, 150, 300, 600, 1200, 1300, 4800, and 9600 baud.
Number of bits per character: 5, 6, 7, or 8 bits.
Parity mode: even, odd, and no parity.
Number of stop bits: 1 or 2.

The control of the sense and flag pins for asynchronous serial I/O, with the appropriate parameters and baud rate, can be done completely with software. The hardware involved is limited to a simple line driver and receiver circuit which may be either and RS-232 interface or a 20mA current loop interface. The interface hardware is shown in Figure 3.

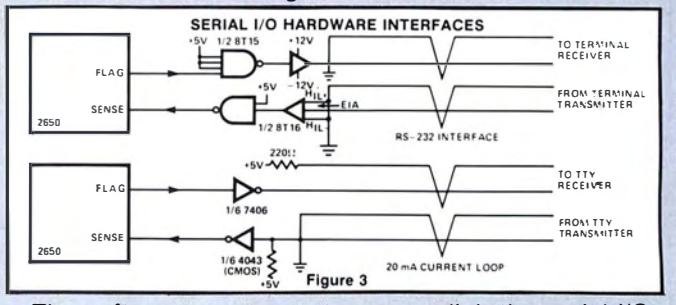


Figure 3

The software necessary to accomplish the serial I/O for a full-duplex line can be divided into 3 parts: 1) The start bit detection and verification. After each start bit detection, the start-bit level is verified for a low level at time intervals of 1/6 of 1-bit time. This prevents false start-bit recognition caused by line noise. 2) The sampling of the data bits at the mid-bit time, echoing the data bit to the flag output, and loading the data bit into a CPU register. 3) The input, echo and check of parity bit and stop bits.

A timing diagram showing the start bit sampling and the bit echo appears in Figure 4.

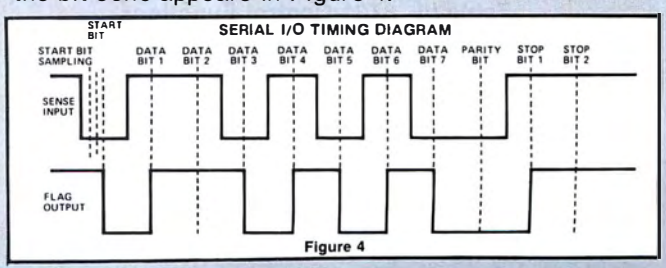


Figure 4

TYPE OF I/O OPERATION	OPREQ	M/$\overline{IO}$	$\overline{R}$/W	ADR0-ADR7	ADR13 (E/$\overline{NE}$)	ADR14 (D/$\overline{C}$)
Sense (Input)	X	X	X	X	X	X
Flag (Output)	X	X	X	X	X	X
Extended Read	H	L	L	Second Byte of Instruction	H	X
Extended Write	H	L	H		H	X
Non-Extended Read C	H	L	L	X	L	L
Non-Extended Read D	H	L	L	X	L	H
Non-Extended Write C	H	L	H	X	L	L
Non-Extended Write D	H	L	H	X	L	H
Memory I/O Read	H	H	L	ADR0-ADR7	ADR13	ADR14
Memory I/O Write	H	H	H	ADR0-ADR7	ADR13	ADR14

X = Don't Care

Table 1. I/O Interface Signal State

BAUD RATE	SAMPLE DELAY NUMBER AT 1.25MHz	BIT DELAY NUMBER AT 1.25MHz	NUMBER OF BDRR,R0 INSTRUCTIONS AT 1.25MHz	NUMBER OF BDRR,R0 INSTRUCTIONS AT 1MHz
110	D0	E5	5	4
300	4A	C5	2	2
600	24	DE	1	1
1200	11	6A	1	1
2400	07	30	1	1

Table II

BUS A			
$\overline{R}_{BA}$	$\overline{W}_{BA}$	CLK	BUS A
X	0	1	WRITE (A→latch)
0	1	X	READ (latch→A)
1	1	X	HI-Z (Tri-state)

BUS B					
$\overline{R}_{BB}$	W_{BB}	$\overline{W}_{BA}$	CLK	$\overline{ME}$	BUS B
X	X	X	X	1	HI-Z
1	0	X	X	0	HI-Z
X	1	0	X	0	HI-Z
0	0	X	X	0	READ (latch→B)
X	1	1	1	0	WRITE (B→latch)

Table III. 8T31 Control Functions

Three examples of the serial I/O routine with different speed and parameters are presented in Figures 5 through 9. The bit and sample delay number (hexadecimal) in the definition listing (Figure 6) are for a CPU clock frequency of 1MHz. The hexadecimal delay numbers for a frequency of 1.25MHz are given in Table 11. This table also lists the number of BDRR,RO instructions that are necessary in the "bit delay and echo subroutine" to count cycles for the appropriate baud rate.

The serial I/O routine uses four CPU registers (1 band and RO) and affects seven of the Program Status Word bits; namely, Sense, Flag, Overflow, Carry Interdigit Carry, and the two Condition Code Bits. The program also uses one level of the return address stack.

A parity error will set the Overflow bit, and a framing error (wrong stop bit level) will set the Interdigit Carry bit. At the end of the routine, the input character is stored in register R2.

DATA SPRING OUTPUT: A typical application for the flag output is a data string output. The advantage for this output method is that it can provide a large number of output bits with little address or control logic decoding. For example, this method can be used to output data for an array of numeric displays, single bit indicators, or column drivers of a parallel numeric printer. An example of the hardware required to implement this type of output channel is given in Figure 10.

Here, the Address 14 output is used as a data strobe signal. However, the data strobe signal could also be built up by decoding more address bits so that the system memory size would not be limited to 16K bytes as in this example.

A listing of the program required is given in Figure 14. The data is assumed to be located in the system's RAM as illustrated in Figure 11.

The least-significant bit of the least-significant byte will be output first. The table length (TLEN) and the number of bits per byte (BPW) can be adapted as necessary by software modifications. The data strobe pulse on output ADR14 is generated by doing the dummy instruction STRA, RO to address H'4000'.

PARALLEL INPUT/OUTPUT

The 2650 instruction set contains the following six input/output instructions:

		NO. BYTES
$\overline{WRTC, RX}$	Write Control	1
$\overline{REDC, RX}$	Read Control	1
$\overline{WRTD, RX}$	Write Data	1
$\overline{REDD, RX}$	Read Data	1
$\overline{WRTE, RX\ DEVA}$	Write Extended	2
$\overline{REDE, RX\ DEVA}$	Read Extended	2

The control signals generated by each I/O instruction simplify the interface circuitry required to generate I/O selection and timing signals. A low-cost control signal interface with related timing is shown in Figures 15 and 16.

When using standard TTL and 8T series I/O ports, the I/O operations can be done without slowing down the system. In this case the $\overline{OPACK}$ input could be controlled directly for all I/O operations.

NON-EXTENDED I/O: The single-byte I/O instructions of the 2650 are referred to as non-extended I/O. In small systems with only two 8-bit input ports and two 8-bit output ports, this I/O facility requires a minimum of hardware interfacing between the CPU and I/O ports. The signals $\overline{WRTC}$, $\overline{WRTD}$, $\overline{REDC}$, and $\overline{REDD}$ generated by the control logic decoder in Figure 15 can be used

FLOWCHART OF THE SERIAL I/O ROUTINE

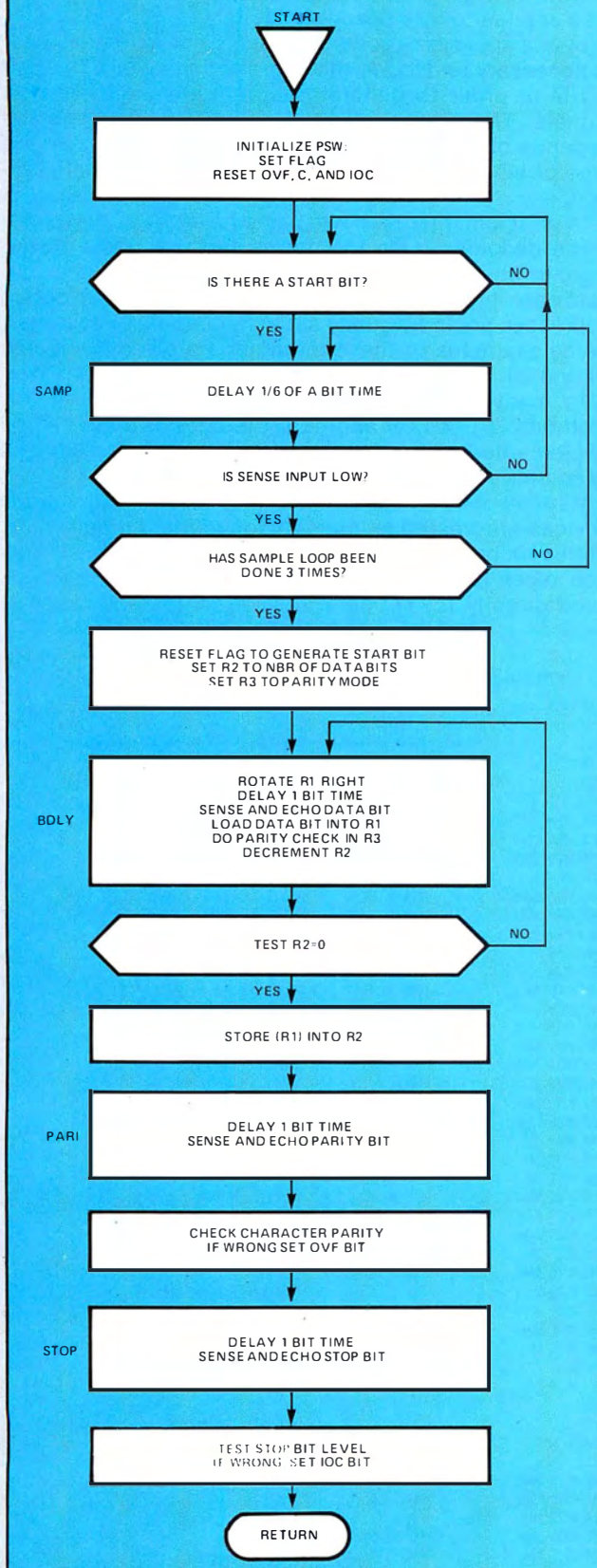


Figure 5

SERIAL I/O PARAMETER DEFINITIONS

```
TWIN ASSEMBLER VER 1.0                                    PAGE 0001

LINE ADDR  OBJECT  E SOURCE

0001                    * PD760891
0002                    ************************************************
0003                    *                                              *
0004                    *      **** PROGRAMMABLE SERIAL I/O ROUTINE **** *
0005                    *                                              *
0006                    * WITH THIS PROGRAM THE SENSE AND FLAG INPUT/OUTPUT OF *
0007                    * THE 2650 ARE USED TO INTERFACE WITH TERMINALS       *
0008                    * SUCH AS TTY, CRT TERMINALS, ETC  VIA THE BIT SERIAL *
0009                    * ASYNCHRONOUS LINE DISCIPLINE                        *
0010                    *                                              *
0011                    * ALL CHARACTER AND LINE PARAMETERS CAN BE MODIFIED   *
0012                    * SIMPLY IN THE SOFTWARE  THESE PARAMETERS ARE BAUD   *
0013                    * RATE, NUMBER OF DATA BITS, PARITY MODE AND STOP BITS *
0014                    *                                              *
0015                    * THE PROGRAM HAS BEEN SET UP FOR A FULL DUPLEX LINE  *
0016                    * BUT CAN EASILY BE MODIFIED TO HALF DUPLEX MODE      *
0017                    *                                              *
0018                    ************************************************
0019                    *
0020                    * DEFINITIONS OF SYMBOLS
0021                    *
0022 0000               R0   EQU    0          PROCESSOR REGISTERS
0023 0001               R1   EQU    1
0024 0002               R2   EQU    2
0025 0003               R3   EQU    3
0026 0080               S    EQU    H'80'      PSU   SENSE
0027 0040               F    EQU    H'40'             FLAG
0028 0020               IDC  EQU    H'20'             INTERDIGIT CARRY
0029 0004               OVF  EQU    H'04'             OVERFLOW
0030 0001               C    EQU    H'01'             CARRY/BORROW
0031 0002               N    EQU    2                 BRANCH CONDITION  NEGATIVE
0032 0003               UN   EQU    3                                   UNCONDITIONAL
0033                    *
0034                    ************************************************************
0035                    *
0036                    * SOFTWARE DEFINITIONS OF BAUD RATE, CHARACTER FORMAT, PARITY,
0037                    * PARITY MODE, ETC
0038                    *
0039                    * NUMBER OF DATA BITS
0040                    *
0041 0006               DB8  EQU    H'06'     CHARACTER HAS 8 DATA BITS
0042 0000               BP8  EQU    H'00'
0043 0007               D07  EQU    H'07'     CHARACTER HAS 7 DATA BITS
0044 0040               BP7  EQU    H'40'
0045 0006               D06  EQU    H'06'     CHARACTER HAS 6 DATA BITS
0046 0020               BP6  EQU    H'20'
0047 0005               D05  EQU    H'05'     CHARACTER HAS 5 DATA BITS
0048 0010               BP5  EQU    H'10'
0049                    *
0050                    * BIT DELAYS AT 1 MHZ CLOCK FREQUENCY
0051                    *
0052 00EB               BR01 EQU    H'EB'     BIT DELAY AT 110 BAUD
0053 0069               BR03 EQU    H'69'     BIT DELAY AT 300 BAUD
0054 0000               BR06 EQU    H'00'     BIT DELAY AT 600 BAUD
0055 0053               BR12 EQU    H'53'     BIT DELAY AT 1200 BAUD
0056 0025               BR24 EQU    H'25'     BIT DELAY AT 2400 BAUD
0057                    *
0058                    * START BIT SAMPLE DELAYS AT 1 MHZ CLOCK FREQUENCY
0059                    *
0060 00A5               SD01 EQU    H'A5'     SAMPLE DELAY AT 110 BAUD
0061 003A               SD03 EQU    H'3A'     SAMPLE DELAY AT 300 BAUD
0062 001C               SD06 EQU    H'1C'     SAMPLE DELAY AT 600 BAUD
0063 000C               SD12 EQU    H'0C'     SAMPLE DELAY AT 1200 BAUD
0064 0005               SD24 EQU    H'05'     SAMPLE DELAY AT 2400 BAUD
0065                    *
0066                    * PARITY MODE
0067                    *
0068 0000               EP   EQU    H'00'     EVEN PARITY
0069 0080               OP   EQU    H'80'     ODD PARITY
0070                    *
```

Figure 6

directly as output port clock pulses and input port enable signals, respectively.

SEQUENTIAL I/O WITH NON-EXTENDED I/O INSTRUCTIONS: In systems where a larger number of devices must be serviced in sequence, the use of a simple 8-bit output port can offer considerable savings in software. Normally the devices could be serviced with extended I/O instructions. However, since the device address is the second byte in this type of instruction, a series of data fetch and I/O instructions would be required to service the devices in sequence.

With an 8-bit output port functioning as a device address register, the device address can be modified under software control. In this way, a simple program loop can serve up to eight I/O ports by rotating a single '1' through a CPU register that is output as a device address. This I/O addressing technique may also be used advantageously in systems where I/O operation requests are detected by software polling. A functional block diagram of this technique is shown in Figure 17.

EXTENDED I/O: There are two extended I/O instructions in the 2650 instruction set. In these 2-byte instructions, the first byte specifies the operation code and the data source or destination register in the CPU. The second byte provides an 8-bit device address code that is output on the eight least-significant bits of the address bus, ADR0 through ADR7.

The control signal decoding diagram (Figure 15) can be simplified for systems using only extended I/O, as shown in Figure 18. The timing diagram of Figure 16 also applies to this decoding technique.

DEVICE ADDRESS DECODING SCHEMES: For extended I/O it is necessary to decode the address lines ADR0 through ADR7 in order to generate appropriate port selection signals. The choice of an address decoding scheme depends on factors such as total I/O requirements, the type of I/O ports used, and the total system configuration.

In principle, there are two basic methods of device address decoding. One method is the use of hardwired logic in which the device address is fixed; the other is a hardware programmable method in which the device addresses are individually set with jumpers or switches. Some examples of these methods are given in Figures 19 and 20.

In many applications a combination of these two methods is used. In addition, the control logic can be implemented as an integral part of the device address decoding. An example is shown in Figure 21.

MEMORY MAPPED I/O: In memory mapped I/O, the I/O devices are treated as memory locations. An advantage of this technique is that all memory referencing instruction types (store, load, arithmetic, logical, etc.) can be used directly for I/O data. Device address decoding is

SERIAL I/O ASSEMBLY LISTING—EXAMPLE 1
110 Baud, 7 Data Bits, Even Parity and 1 Stop Bit

```
LINE ADDR  OBJECT  E SOURCE

0073               ********************************************************************
0074               * EXAMPLE 1  FULL DUPLEX (BIT BY BIT ECHO), 110 BAUD,
0075               * 7 DATA BITS, EVEN PARITY AND 1 STOP BIT
0076               *
0077 0000                ORG    H'0500'
0078 0500 7640     STRT PPSU   F          SET FLAG TO SWITCH OFF THE LINE
0079 0502 7525           CPSL   OVF+C+IDC
0080 0504 12       TEST SPSU              WAIT FOR START BIT
0081 0505 1A7D           BCTR,N TEST
0082 0507 0603           LODI,R2 H'03'     SET R2 TO NUMBER OF SAMPLES
0083 0509 054A     SAMP LODI,R1 5061      SET R1 TO SAMPLE DELAY
0084 050B F97E           BDRR,R1 $
0085 050D 12             SPSU             TEST FOR START BIT VALIDITY
0086 050E 1A74           BCTR,N  TEST     IF NOT VALID, GO BACK TO TEST
0087 0510 FA77           BDRR,R2 SAMP
0088 0512 0700           LODI,R3 EP       SET R3 TO EVEN PARITY MODE
0089 0514 0607           LODI,R2 D87      SET R2 TO NUMBER OF DATA BITS
0090 0516 7440           CPSU    F        GENERATE START BIT
0091 0518 51       BITS RRR,R1
0092 0519 3B12           BSTR,UN BDLY     GO TO DELAY AND ECHO ROUTINE
0093 051B FA7B           BDRR,R2 BITS     TEST FOR NUMBER OF DATA BITS
0094 051D 01             LODZ    R1
0095 051E C2             STRZ    R2       LOAD R2 WITH CHARACTER
0096 051F 3B0C     PARI BSTR,UN BDLY
0097 0521 9402           BCFR,N  STOP
0098 0523 7704           PPSL    OVF      IF WRONG PARITY, SET OVF
0099 0525 0700     STOP LODI,R3 0        CLEAR R3
0100 0527 3B04           BSTR,UN BDLY
0101 0529 16       EXI1 RETC,N           TEST STOP BIT LEVEL
0102 052A 7720           PPSL    IDC      IF WRONG, SET IDC BIT
0103 052C 17       EXI2 RETC,UN
0104               *
0105               ********************************************************************
0106               * BIT DELAY AND ECHO SUBROUTINE
0107               *
0108 052D 04EB     BDLY LODI,R0 BR01     SET R0 TO BIT DELAY NUMBER
0109 052F F87E           BDRR,R0 $
0110 0531 F87E           BDRR,R0 $
0111 0533 F87E           BDRR,R0 $
0112 0535 F87E           BDRR,R0 $
0113 0537 12             SPSU             TEST DATABIT LEVEL
0114 0538 1A04           BCTR,N  ONE
0115 053A 7440           CPSU    F        IF LOW, ECHO A ZERO
0116 053C 1B04           BCTR,UN BIT1
0117 053E 7640     ONE   PPSU    F        IF HIGH, ECHO A ONE
0118 0540 6540           IORI,R1 BP7      INSERT DATABIT INTO R1
0119 0542 23       BIT1 EORZ    R3
0120 0543 C3             STRZ    R3       DO PARITY CHECK
0121 0544 17             RETC,UN
0122               *
0123 0000                END  0

TOTAL ASSEMBLY ERRORS = 0000
```

Figure 7

EXAMPLE 2
600 Baud, 7 Data Bits, Odd Parity and 2 Stop Bits

```
LINE ADDR  OBJECT  E SOURCE

0073               ********************************************************************
0074               * EXAMPLE 2  FULL DUPLEX (BIT BY BIT ECHO), 600 BAUD,
0075               * 7 DATA BITS, ODD PARITY AND 2 STOP BITS
0076               *
0077 0000                ORG    H'0500'
0078 0500 7640     STRT PPSU   F          SET FLAG TO SWITCH OFF THE LINE
0079 0502 7525           CPSL   OVF+C+IDC
0080 0504 12       TEST SPSU              WAIT FOR START BIT
0081 0505 1A7D           BCTR,N  TEST
0082 0507 0603           LODI,R2 H'03'     SET R2 TO NUMBER OF SAMPLES
0083 0509 051C     SAMP LODI,R1 5066      SET R1 TO SAMPLE DELAY
0084 050B F97E           BDRR,R1 $
0085 050D 12             SPSU             TEST FOR START BIT VALIDITY
0086 050E 1A74           BCTR,N  TEST     IF NOT VALID, GO BACK TO TEST
0087 0510 FA77           BDRR,R2 SAMP
0088 0512 0760           LODI,R3 OP       SET R3 TO ODD PARITY MODE
0089 0514 0607           LODI,R2 D87      SET R2 TO NUMBER OF DATA BITS
0090 0516 7440           CPSU    F        GENERATE START BIT
0091 0518 51       BITS RRR,R1
0092 0519 3B1A           BSTR,UN BDLY     GO TO DELAY AND ECHO ROUTINE
0093 051B FA7B           BDRR,R2 BITS     TEST FOR NUMBER OF DATA BITS
0094 051D 01             LODZ    R1
0095 051E C2             STRZ    R2       LOAD R2 WITH CHARACTER
0096 051F 3B14     PARI BSTR,UN BDLY
0097 0521 9402           BCFR,N  STO1
0098 0523 7704           PPSL    OVF      IF WRONG PARITY, SET OVF
0099 0525 0700     STO1 LODI,R3 0        CLEAR R3
0100 0527 3B0C           BSTR,UN BDLY
0101 0529 1A02           BCTR,N  STO2     TEST STOP BIT LEVEL
0102 052B 7720           PPSL    IDC      IF WRONG, SET IDC BIT
0103 052D 0700     STO2 LODI,R3 0        CLEAR R3
0104 052F 3B04           BSTR,UN BDLY
0105 0531 16       EXI1 RETC,N           TEST STOP BIT 2 LEVEL
0106 0532 7720           PPSL    IDC      IF WRONG, SET IDC BIT
0107 0534 17       EXI2 RETC,UN
0108               *
0109               ********************************************************************
0110               * BIT DELAY AND ECHO SUBROUTINE
0111               *
0112 0535 04B0     BDLY LODI,R0 BR06     SET R0 TO BIT DELAY NUMBER
0113 0537 F87E           BDRR,R0 $
0114 0539 12             SPSU             TEST DATA BIT LEVEL
0115 053A 1A04           BCTR,N  ONE
0116 053C 7440           CPSU    F        IF LOW, ECHO A ZERO
0117 053E 1B04           BCTR,UN BIT1
0118 0540 7640     ONE   PPSU    F        IF HIGH, ECHO A ONE
0119 0542 6540           IORI,R1 BP7      INSERT DATA BIT INTO R1
0120 0544 23       BIT1 EORZ    R3
0121 0545 C3             STRZ    R3       DO PARITY CHECK
0122 0546 17             RETC,UN
0123               *
0124 0000                END  0

TOTAL ASSEMBLY ERRORS = 0000
```

Figure 8

not necessarily more complex than for normal extended I/O, since all I/O addresses could be located in a specific address block. Of course, this technique can only be used in systems which do not use the full memory address space for programs. A diagram of the I/O control logic, using the ADR14 output to discriminate between memory and I/O operations, is given in Figure 22. The device address decoding methods described earlier can also be applied to memory mapped I/O.

SINGLE POINT CONTROL

In many applications, the capability to set, clear, or test a single output point selected from a large number of output points is required. Designs of this type can be implemented using the 2650 I/O instructions. When used as described below, the WRTE, WRTC, and WRTD instructions become "set/clear single-bit" instructions, while the REDE instruction becomes a "test single-bit" instruction.

SINGLE BIT OUTPUT-DIRECT ADDRESS: The write extended instruction can be used to select and set or clear a single output bit. The two bytes of the instruction can be interpreted as follows:

BYTE 0

1	1	0	1	0	1	X	X

BYTE 1

S/C	A_6	A_5	A_4	A_3	A_2	A_1	A_0

EXAMPLE 3
2400 Baud, 8 Data Bits, No Parity and 1 Stop Bit

```
LINE ADDR  OBJECT  E SOURCE

0073               ********************************************************
0074               * EXAMPLE 3  FULL DUPLEX (BIT BY BIT ECHO), 2400 BAUD,
0075               * 8 DATA BITS, NO PARITY AND 1 STOP BIT
0076               *
0077 0000                ORG    H'0500'
0078 0500 7640     STRT  PPSU   F          SET FLAG TO SWITCH OFF THE LINE
0079 0502 7525           CPSL   OVF+IDC
0080 0504 12       TEST  SPSU             WAIT FOR START BIT
0081 0505 1A7D           BCTR,N  TEST
0082 0507 0603           LODI,R2 H'03'     SET R2 TO NUMBER OF SAMPLES
0083 0509 0525     SAMP  LODI,R1 SD24     SET R1 TO SAMPLE DELAY
0084 050B F97E           BDRR,R1 $
0085 050D 12             SPSU             TEST FOR START BIT VALIDITY
0086 050E 1A74           BCTR,N  TEST     IF NOT VALID, GO BACK TO TEST
0087 0510 FA77           BDRR,R2 SAMP
0088 0512 0608           LODI,R2 D8'8'    SET R2 TO NUMBER OF DATA BITS
0089 0514 7440           CPSU   F         GENERATE START BIT
0090 0516 51       BITS  RRR,R1
0091 0517 3B0C           BSTR,UN BDLY     GO TO DELAY AND ECHO ROUTINE
0092 0519 FA7B           BDRR,R2 BITS     TEST FOR NUMBER OF DATA BITS
0093 051B 01             LODZ   R1
0094 051C C2             STRZ   R2        LOAD R2 WITH CHARACTER
0095 051D 0700     STOP  LODI,R3 0        CLEAR R3
0096 051F 3B04           BSTR,UN BDLY
0097 0521 16       EXI1  RETC,N           TEST STOP BIT LEVEL
0098 0522 7720           PPSL   IDC       IF WRONG, SET IDC BIT
0099 0524 17       EXI2  RETC,UN
0100               *
0101               ********************************************************
0102               * BIT DELAY AND ECHO SUBROUTINE
0103               *
0104 0525 0425     BDLY  LODI,R0 BR24     SET R0 TO BIT DELAY NUMBER
0105 0527 F87E           BDRR,R0 $
0106 0529 12             SPSU             TEST DATA BIT LEVEL
0107 052A 1A04           BCTR,N  ONE
0108 052C 7440           CPSU   F         IF LOW, ECHO A ZERO
0109 052E 1B04           BCTR,UN BIT1
0110 0530 7640     ONE   PPSU   F         IF HIGH, ECHO A ONE
0111 0532 6580           IORI,R1 B'0'     INSERT DATA BIT INTO R1
0112 0534 C3       BIT1  STRZ   R3
0113 0535 17             RETC,UN
0114               *
0115 0000                END    0

 TOTAL ASSEMBLY ERRORS = 0000
```

Figure 9

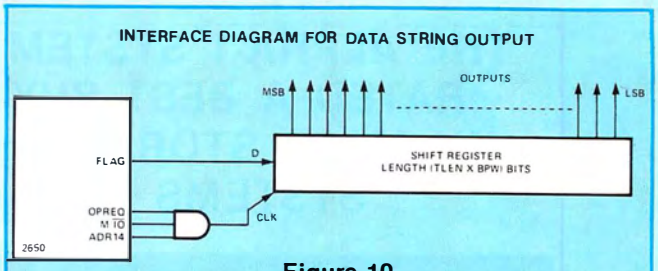


Figure 10.

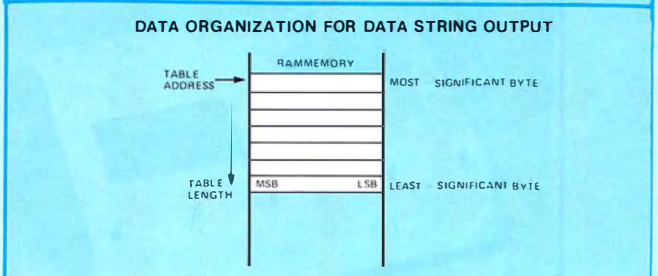


Figure 11.

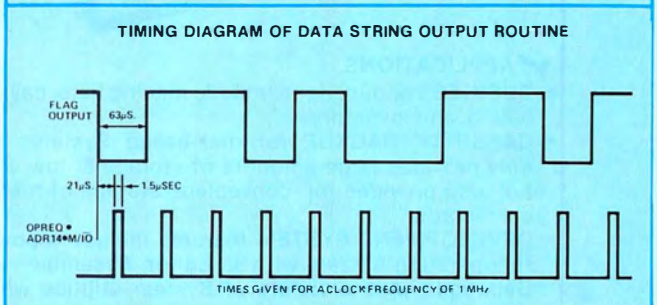


Figure 12.

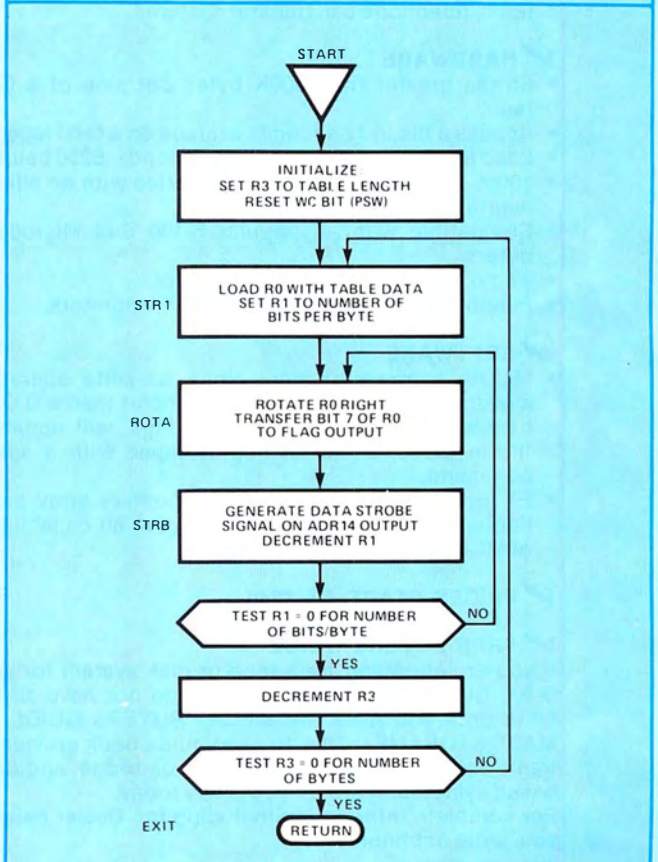


Figure 13.

A_0 through A_6 of the second byte specify the output selected. The S/C bit specifies whether the bit is set or cleared. A typical hardware configuration controlling 64 points is shown in Figure 23. Here, the control line decoding and partial address decoding is done by the 74LS138, which selects one of the eight 9334s. One of the eight latches in the selected 9334 is enabled by ADR0, ADR1, and ADR2 and is either cleared or set, as determined by the value of ADR7.

The XX field in the first byte selects one of the four available registers and outputs in its contents on the data bus. Since this information is not used in this application, the value of XX is not important. However, it could be used to output an 8-bit control or status word in conjunction with the set/clear operation.

SINGLE BIT OUTPUT-INDIRECT ADDRESS: If the address of the output to be set or cleared must be determined at program run time, the $\overline{\text{WRTD}}$ and $\overline{\text{WRTC}}$ instructions can be used. The address of the output bit is first loaded into one of the 2650 registers. A $\overline{\text{WRTD}}$, Rx instruction is

ASSEMBLY LISTING OF DATA STRING OUTPUT ROUTINE

```
LINE ADDR  OBJECT  E SOURCE

0001                    * PD760094
0002                    ********************************************************************
0003                    *                                                                  *
0004                    *              **** DATA STRING OUTPUT ROUTINE ****                *
0005                    *                                                                  *
0006                    * THIS PROGRAM TRANSFERS THE CONTENTS OF A MEMORY TABLE IN BIT BY  *
0007                    * BIT SERIAL FORM TO THE FLAG OUTPUT OF THE 2650                   *
0008                    *                                                                  *
0009                    * THE TABLE LENGTH AND THE NUMBER OF BITS ARE SOFTWARE PROGRAMMED  *
0010                    *                                                                  *
0011                    * A DATA STROBE OUTPUT IS GENERATED ON THE ADDRESS 14 OUTPUT       *
0012                    *                                                                  *
0013                    ********************************************************************
0014                    *
0015                    * DEFINITIONS OF SYMBOLS
0016                    *
0017 0000               R0   EQU   0          PROCESSOR REGISTERS
0018 0001               R1   EQU   1
0019 0002               R2   EQU   2
0020 0003               R3   EQU   3
0021 0080               S    EQU   H'80'      PSU   SENSE
0022 0040               F    EQU   H'40'            FLAG
0023 0020               WC   EQU   H'20'      PSL   1=WITH, 0=WITHOUT CARRY
0024 0002               N    EQU   2          BRANCH COND    NEGATIVE
0025 0003               UN   EQU   3                         UNCONDITIONAL
0026                    *
0027 0007               TLEN EQU   H'07'      TABLE LENGTH
0028 0008               BPW  EQU   H'08'      NUMBER OF BITS PER BYTE
0029                    *
0030 0000                    ORG   H'0600'
0031 0600               TABL RES   TLEN       LOCATION OF TABLE
0032                    *
0033                    ********************************************************
0034                    *
0035 0607                    ORG   H'0500'
0036 0500 0707          STRT LOD1,R3 TLEN
0037 0502 7508               CPSL  WC
0038 0504 0F0600        STR1 LODA,R0 TABL,R3   LOAD R0 WITH TABLE DATA
0039 0507 0508               LOD1,R1 BPW       SET R1 TO NUMBER OF BITS PER BYTE
0040 0509 50            ROTA RRR,R0
0041 050A 1A06               BCTR,N  ONE       TEST BIT
0042 050C 7440          ZERO CPSU    F         IF ZERO, RESET FLAG
0043 050E 1E04               BCTR,UN STRB
0044                    *
0045 0510 4000          ADR  DATA H'40,00
0046                    *
0047 0512 7640          ONE  PPSU    F         IF ONE, SET FLAG
0048 0514 CC8510        STRB STRA,R0 *ADR      GENERATE STROBE SIGNAL ON A14
0049 0517 F97C               BDRR,R1 ROTA      TEST FOR NUMBER OF BITS
0050 0519 FB69               BDRR,R3 STR1      TEST FOR NUMBER OF BYTES
0051 051B 17            EXIT RETC,UN
0052 0000                    END 0

 TOTAL ASSEMBLY ERRORS = 0000
```

Figure 14

Computer Mainframe System

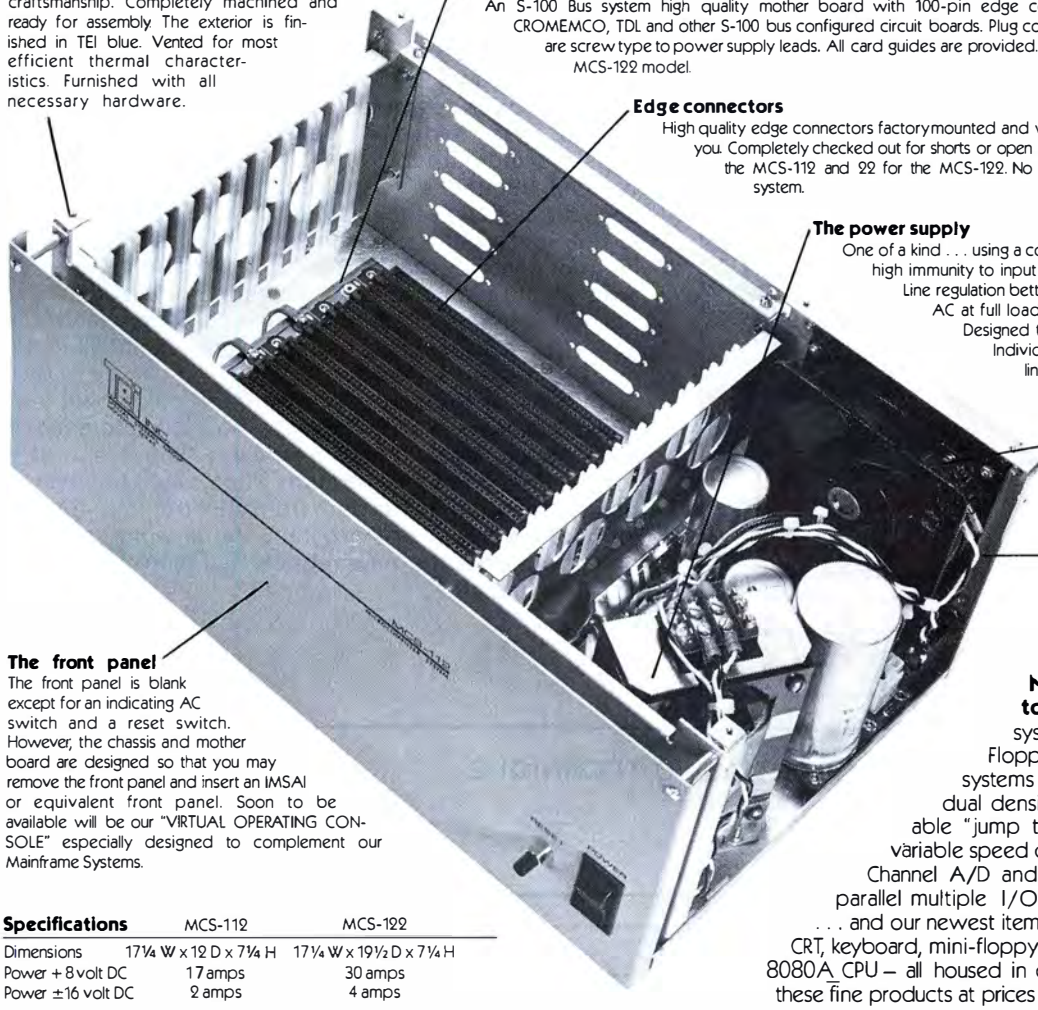
First in the TEI family . . . The MCS-112 and 122 Mainframe Systems.

"The Base on Which to Build"

The cabinet
A heavy duty, precision formed cabinet of fine craftsmanship. Completely machined and ready for assembly. The exterior is finished in TEI blue. Vented for most efficient thermal characteristics. Furnished with all necessary hardware.

The motherboard
An S-100 Bus system high quality mother board with 100-pin edge connectors. Compatible with IMSAI, MITS, CROMEMCO, TDL and other S-100 bus configured circuit boards. Plug connections for reset switch. Voltage terminals are screw type to power supply leads. All card guides are provided. 12 slots for MCS-112 model and 22 slots for MCS-122 model.

Edge connectors
High quality edge connectors factory mounted and wave soldered to eliminate this nuisance for you. Completely checked out for shorts or open traces. ALL edge connectors furnished, 12 for the MCS-112 and 22 for the MCS-122. No additional expense when you expand your system.



The power supply
One of a kind . . . using a constant voltage transformer (CVT) with a very high immunity to input line noise . . . greater than 100 db rejection. Line regulation better than ± 1% from an input of 95 to 140 Volt AC at full load to 85 to 140 Volt AC at three quarter load. Designed to meet UL-478 specifications (EDP SPECS). Individual fusing on all input and output voltage lines. See specifications below for power ratings.

The cooling system
A 115 CFM muffin fan with a commercial grade washable filter will provide clean airflow over all circuitry.

The wiring
All wiring is color coded and ALL is precut to length with connecting lugs factory machine applied. Soldering is held to an absolute minimum.

The front panel
The front panel is blank except for an indicating AC switch and a reset switch. However, the chassis and mother board are designed so that you may remove the front panel and insert an IMSAI or equivalent front panel. Soon to be available will be our "VIRTUAL OPERATING CONSOLE" especially designed to complement our Mainframe Systems.

Specifications	MCS-112	MCS-122
Dimensions	17¼ W x 12 D x 7¼ H	17¼ W x 19½ D x 7¼ H
Power + 8 volt DC	17 amps	30 amps
Power ±16 volt DC	2 amps	4 amps

NOW ... TEI puts it all together for you. Mainframe systems (6, 12 and 22-slot) . . . Floppy and mini-floppy disc drive systems (single, double and triple with dual density) . . . a Z-80 CPU with addressable "jump to" and autostart capability (also variable speed control) . . . 8K and 16K RAM . . . 16 Channel A/D and D/A converter . . . 3 serial + 3 parallel multiple I/O . . . and other supporting boards . . . and our newest item, the PROCESSOR TERMINAL — A CRT, keyboard, mini-floppy disc and 12-slot mainframe with a 8080A CPU – all housed in one quality aluminum case. All of these fine products at prices you will like. **Watch for them all.**

Contact your local TEI dealer or if you are not near one of our dealers, write or call CMC MARKETING CORP direct for more information.

(DEALER INQUIRIES INVITED)

PLEASE SEND ME:

☐ MCS-112 Kit @ 395.00 ☐ MCS-112 Assembled @ 445.00

☐ MCS-122 Kit @ 495.00 ☐ MCS-122 Assembled @ 575.00

Texas residents add 5% Sales Tax

I Enclose Check ☐ or Money Order ☐

CMC MARKETING CORP

7231 Fondren Rd, Houston, TX 77036 Telephone (713) 774-9526

TEI INC.

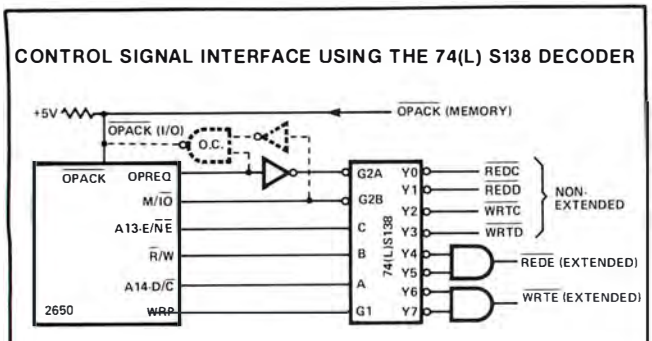


Figure 15.

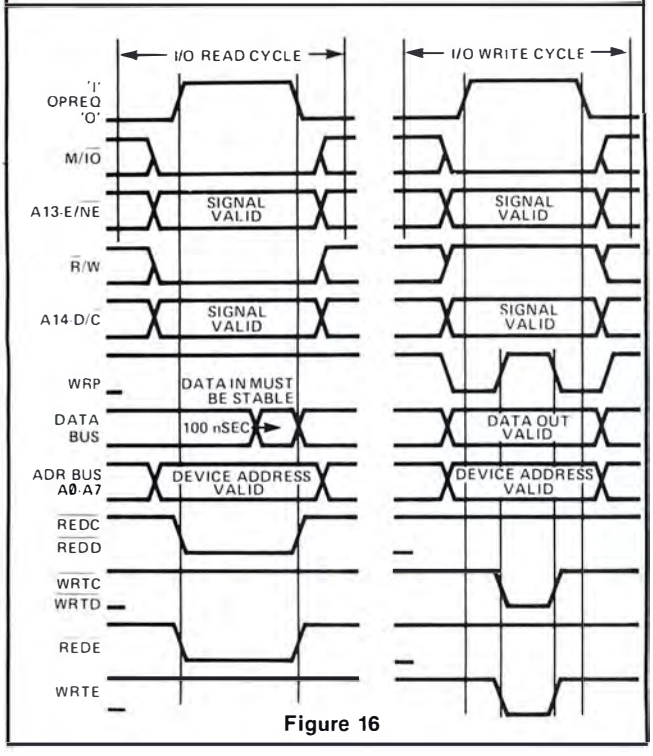


Figure 16

then issued if the bit is to be set, and a $\overline{\text{WRTC}}$, Rx instruction is issued if the bit is to be cleared. The bit select is output on the data bus, and the D/C output carries the *set/clear* information. The hardware implementation can be the same as shown in Figure 23, except that ADR0-ADR5 are replaced by DBUS0-DBUS5, and ADR7 is replaced by D/C.

The 8T31 can be used to implement a flag register without the use of a memory byte in RAM. No additional hardware required and memory savings are considerable.

SINGLE BIT INPUT: One way of doing single bit input uses the techniques described earlier. The address of the bit that is to be tested is loaded into one of the 2650 registers and output to an 8-bit latch using an extended or non-extended write instruction. The latch output is decoded to select the desired bit, which is then applied to the Sense input pin. The 2650 Program Status Word instructions can then be used to test the state of the Sense input and to take appropriate program action.

The technique described above must be used if "indirect" bit addressing is required. If this is not a requirement, a more efficient implementation can be accomplished using the extended *read* instruction. This technique makes use of the fact that the 2650 automatically tests the contents of a register every time it is used as the destination of an operation. Thus, when the *read* extended operation reads data from an input port, the condition code bits in the program status word are set to reflect whether the new register contents is positive, negative, or zero.

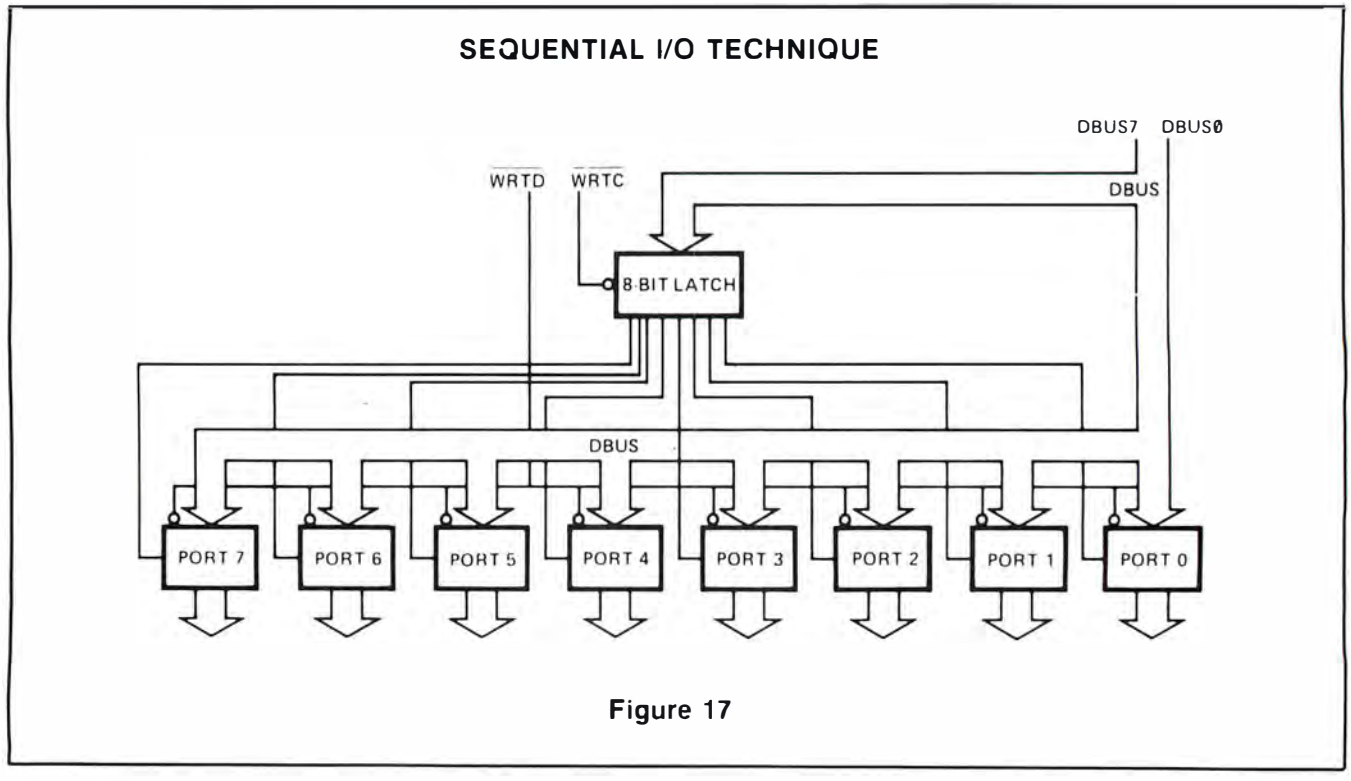
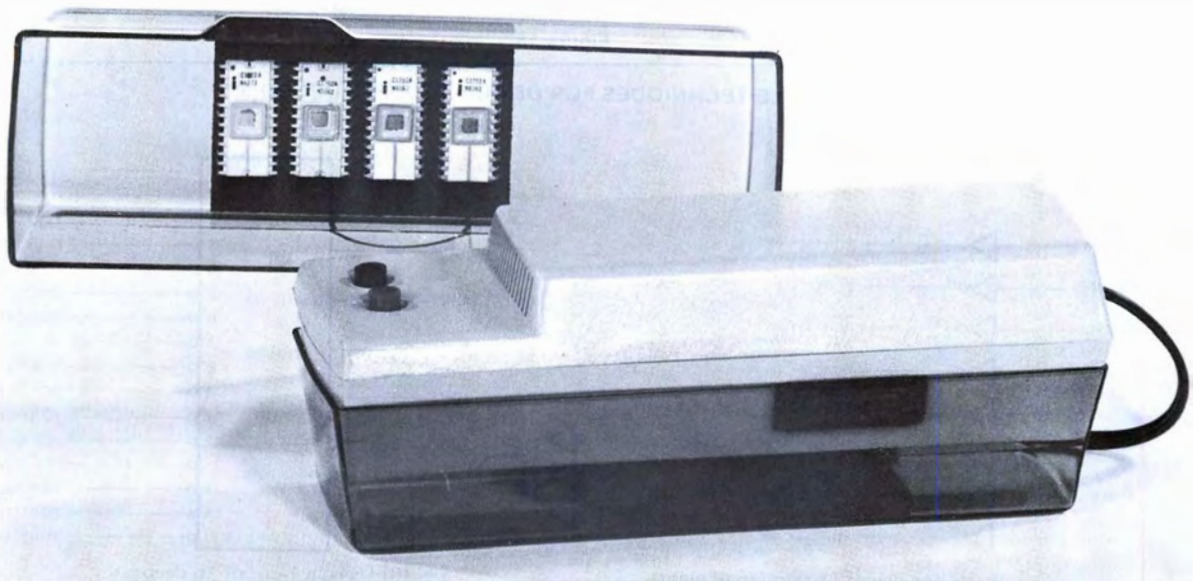


Figure 17

New UVS-11E EPROM Erasing System



Performance and Reliability for $59.50

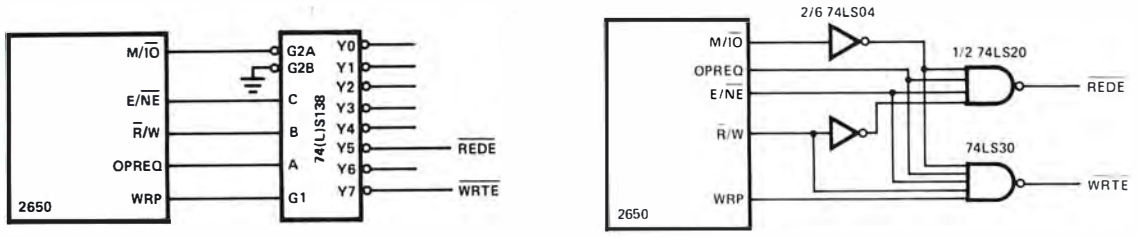
Now available . . . the newest member of UVP's growing family of quality EPROM Erasing Lamps. The UVS-11E Short Wave UV Lamp was designed specifically for the small systems user and computer hobbyist. It's compact, easy-to-use, and will erase up to 4 chips at one time. It even features a special safety interlock system for complete safety.

This is the first UV erasing system to offer simple operation and foolproof safety features at an affordable price. Like all UVP products, the UVS-11E is quality-built and backed by 45 years of UV technology.

Order now from your local authorized UVP stocking dealer. Or write today for more information and name of nearest dealer.

ULTRA-VIOLET PRODUCTS, INC.
5100 Walnut Grove Avenue, San Gabriel, CA 91778 U.S.A.

SIMPLIFIED CONTROL LOGIC WHEN USING EXTENDED I/O ONLY

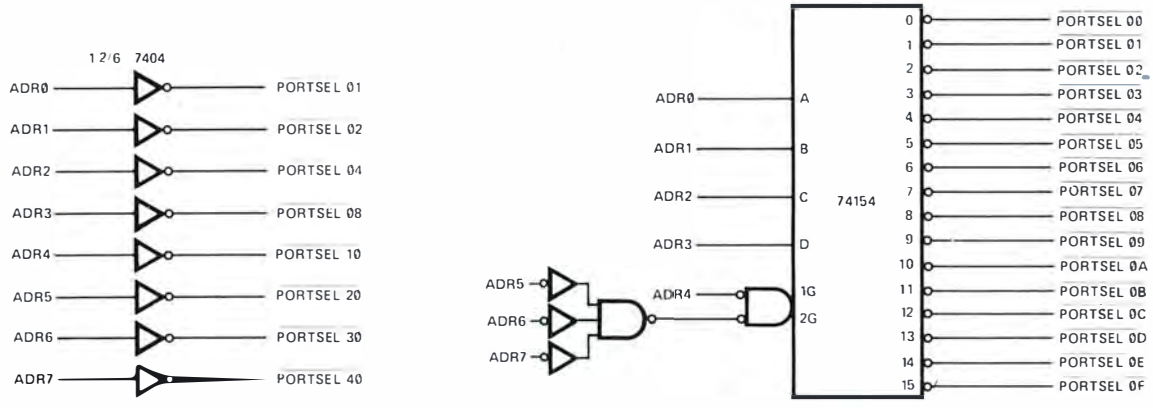


(A) Using 1-of-8 Decoder

(B) Using Logic Gates

Figure 18

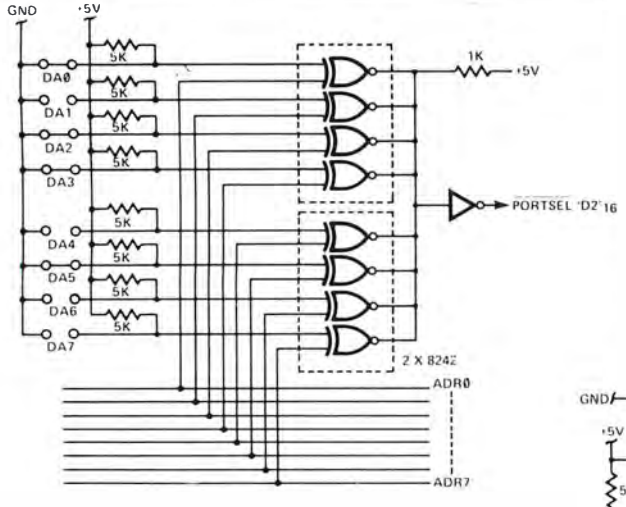
SOME POSSIBLE TECHNIQUES FOR DEVICE ADDRESS DECODING



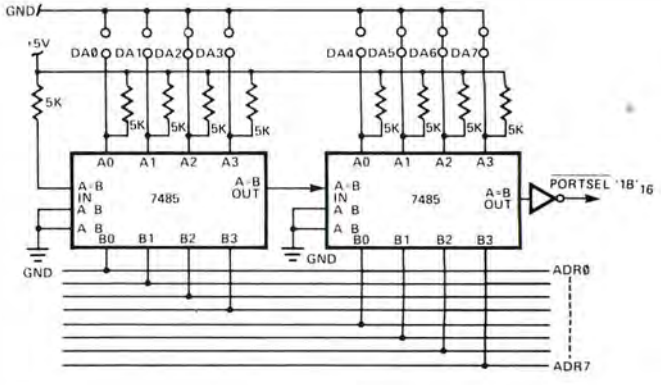
(A) Each address line selects one device (maximum of eight)

(B) Using a 1-out-of-16 decoder

Figure 19



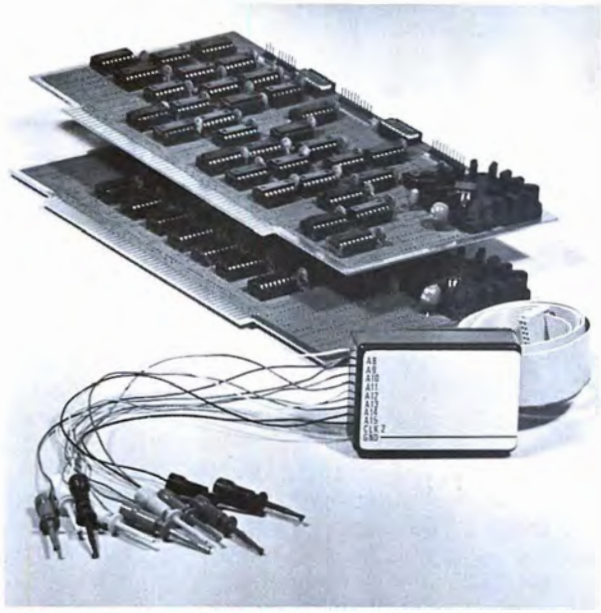
(A) Using Exclusive-OR Gates



(B) Using Comparators

Figure 20

24 channel Logic Analzer plugs into your S-100 Bus



24 Channel **LOGIC ANALYZER**, complete with 2 cards and 3 sets of probes (only one set shown).

Features

- 24 channels with 256 samples each.
- Display of disassembled program flow.
- Dual mode operation — external mode analyses any external logic system. Internal mode monitors users data and address bus.
- Selectable trigger point anywhere in the 256 samples.
- 0-16 bit trigger word format or external qualifier.
- 10MHz sample rate (50ns min. pulse width)
- Synchronous clock sample with coincident or delayed clock mode.
- User defined reference memory.
- Displays and system control through keyboard entry.
- TTL Logic level compatible (15 pf and 15 μa typical input loading).
- Includes annotated source listing.

Display of disassembled program flow.

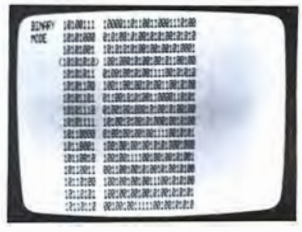
The DATALYZER

The Databyte Logic Analyzer (DATALYZER) is a convenient, flexible, high quality device. Efficient engineering has allowed a combination of features previously available in only the most expensive units.

Designed to plug easily into your S-100 Bus, the DATALYZER is a complete system —- for only $495. Display of disassembled program flow is a standard feature, not an extra. And the low price includes 30 logic probes, so you can hook up immediately, without additional expense.

The DATALYZER is available in kit form ($495), and as a fully assembled device on two PCB's ($595). Four-week delivery, a substantial warranty, and the Databyte, Inc. commitment to service make the DATALYZER a worthwhile investment. Begin debugging by sending the coupon now.

Displays in Hex



Displays in Binary

Please send me the 24 Channel **LOGIC ANALYZER**

☐ Kit — (manual included) $495.00 (Wis. res. add 4%)

☐ Assembled and Tested (manual included) $595.00

☐ Operators' manual only $7.50

Delivery of all items in four weeks to:

Name _____

Address _____

City _____ State _____ Zip _____

Telephone _____

Payment Enclosed: ☐ Check ☐ Money Order

☐ BankAmericard ☐ Master Charge Exp. Date _____

Number _____

Signature _____

Databyte, Inc.

P.O. Box 14
7433 Hubbard Avenue
Middleton, Wisconsin 53562
Tel: (608) 831-7666

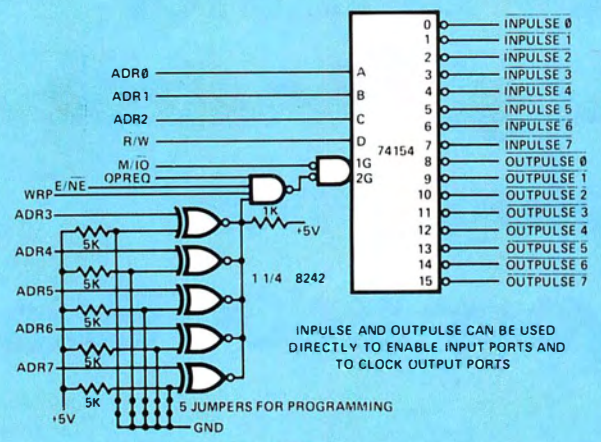


Figure 21.

I/O CONTROL SIGNAL GENERATION FOR MEMORY MAPPED I/O

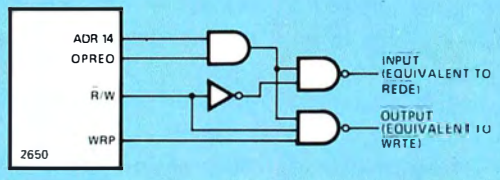


Figure 22.

SIXTY-FOUR SINGLE BIT OUTPUTS USING THE 9334

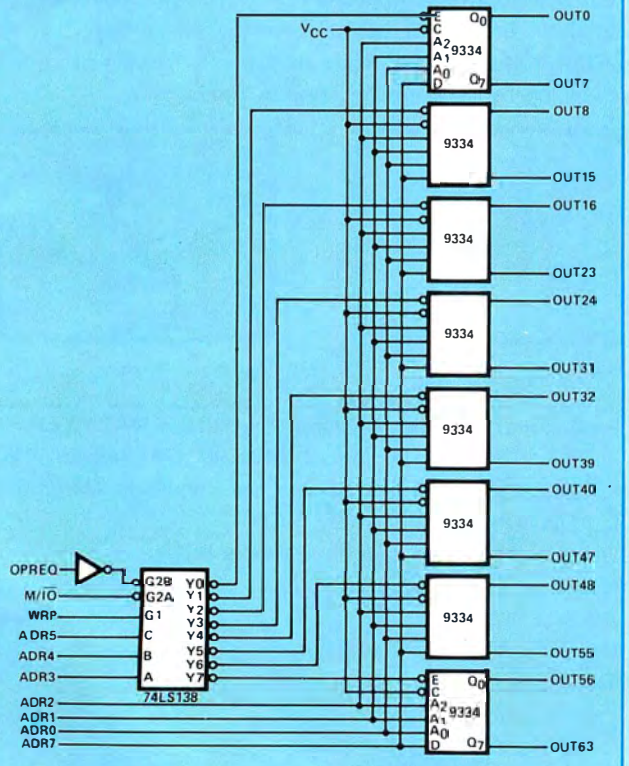


Figure 23.

For the single bit input application, the second byte of the RETE, Rx instruction contains the address of the input bit to be tested. This data is applied to a bank of data selectors to select the addressed bit, which is then applied to the most-significant bit of the data bus, DBUS7. Since this is interpreted as the sign bit, the condition code bits in PSL will be set to reflect whether the bit being tested is a one or zero. A conditional branch instruction can then be used to affect the desired program action. A hardware implementation for 64 inputs is shown in Figure 24. Note that an address latch is not required for this method.

INPUT PORT DEVICES

GATED INPUT PORTS: The simplest form of an input port is the tri-state gate. Figure 25 illustrates the use of the 8T97 high-speed HEX tri-state buffer for gated input ports. The 8T97 is non-inverting, and the tri-state control signals enable the buffers in groups of four and groups of two, so that 8-bit ports can be implemented efficiently.

An effective circuit for systems using 8-gated input ports is the 74251 8-to-1 multiplexer, which has tri-state outputs that can interface directly with the data bus. The advantage of this circuit is that no external address decoding logic is needed. A configuration using gated input ports with the 74251 multiplexer is illustrated in Figure 26.

In addition to these two configurations, many other input port configurations are possible using standard TTL or Signetics 8T series logic circuits.

LATCHING INPUT PORTS: Latching input ports may be required to store data from an external device, which is available only momentarily, before the actual input operation to the microprocessor takes place. This type of input port can be realized by connecting TTL-latch or D-type flip-flop circuits, such as the 7475, 74100, or 74175, to the inputs of a gated input port. As illustrated in Figure 27, by using the Signetics 8T10 Quad D-type flip-flop with tri-state outputs, an 8-bit latching input port can be implemented with only two packages. The 8T10 is functionally identical to the 74173.

OUTPUT PORT DEVICES

Output ports can be configured with a variety of standard TTL and 8T series flip-flops and registers. Typical circuits include:

9334	Addressable 8-bit latch
7475	Quadruple latch
74100	8-bit latch
74175	Quadruple D-type flip-flop
8T10	Quadruple D-type flip-flop with tri-state ouputs

The 7475 and 74175 both have true and complement outputs. One special feature of the 8T10 is that the outputs may be disabled (placed in a high-impedance output mode) by the device that is connected to this output port. A logic diagram using these circuits for output ports appears in Figure 28.

The 9334 is useful in systems requiring a large number of latched outputs, since a portion of the decoding can be done using the on-chip 3-input decoder. A typical application of this was shown in Figure 23. It is also an efficient circuit for implementing eight 8-bit output ports.

I/O CONFIGURATIONS USING THE 8T31 BIDIRECTIONAL PORT

The 8T31 is an 8-bit bidirectional I/O port consisting of eight clocked latches with two bidirectional I/O buses, each of which has its own control logic. Each bus (A and B) has a read and a write control input, and there is a

master enable input for bus B only. The outputs of the latches follow the inputs when the clock is high, and latching will occur when the clock returns low.

The 8T31 is also equipped with a "power-on clear" circuit. If the clock input is held low until the power supply reaches 3.5V, the latches will be cleared. There is a logic inversion between bus A and bus B. As a result, when the 8T31 is cleared, bus A will have all logic "1" outputs and bus B all logic "0" outputs.

The control functions of the 8T31 are listed in Table 111. A functional block diagram and a symbolic diagram of the 8T31 are illustrated in Figures 29 and 30, respectively. As shown in Table 111, each bus can operate independently except for the care of writing from both bus A and B. In this case writing from bus A will override any attempt to write from bus B.

The control functions of the 8T31 allow it to be used in various microcomputer input/output applications. In the I/O system diagram of Figure 31, the 8T31 is used to implement gated input ports, latching input ports, output ports, and a bidirectional data bus driver. All I/O ports can be controlled directly with the device select and $\overline{\text{REDE}}$ and $\overline{\text{WRTE}}$ lines coming from device decoders and I/O control logic.

In applications where interfacing is necessary with peripheral devices that need data transfers in two directions, like digital cassettes and data link communication circuits, the 8T31 can be used as a bidirectional I/O port. In this application, the I/O operation should be requested by interrupt or polling to prevent simultaneous

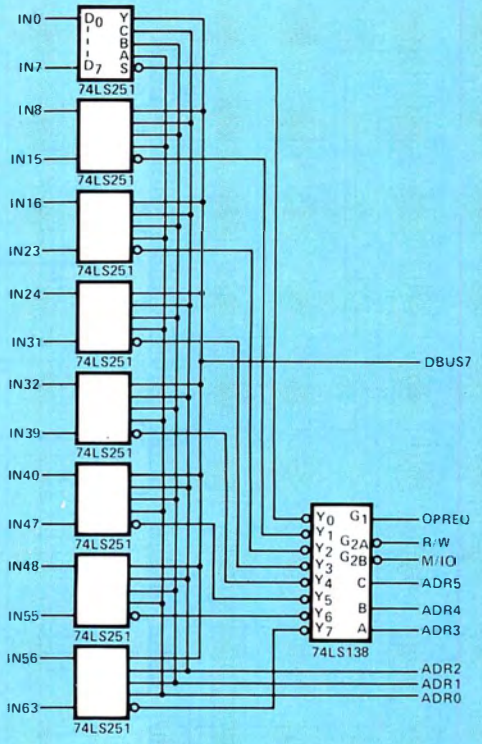


Figure 24

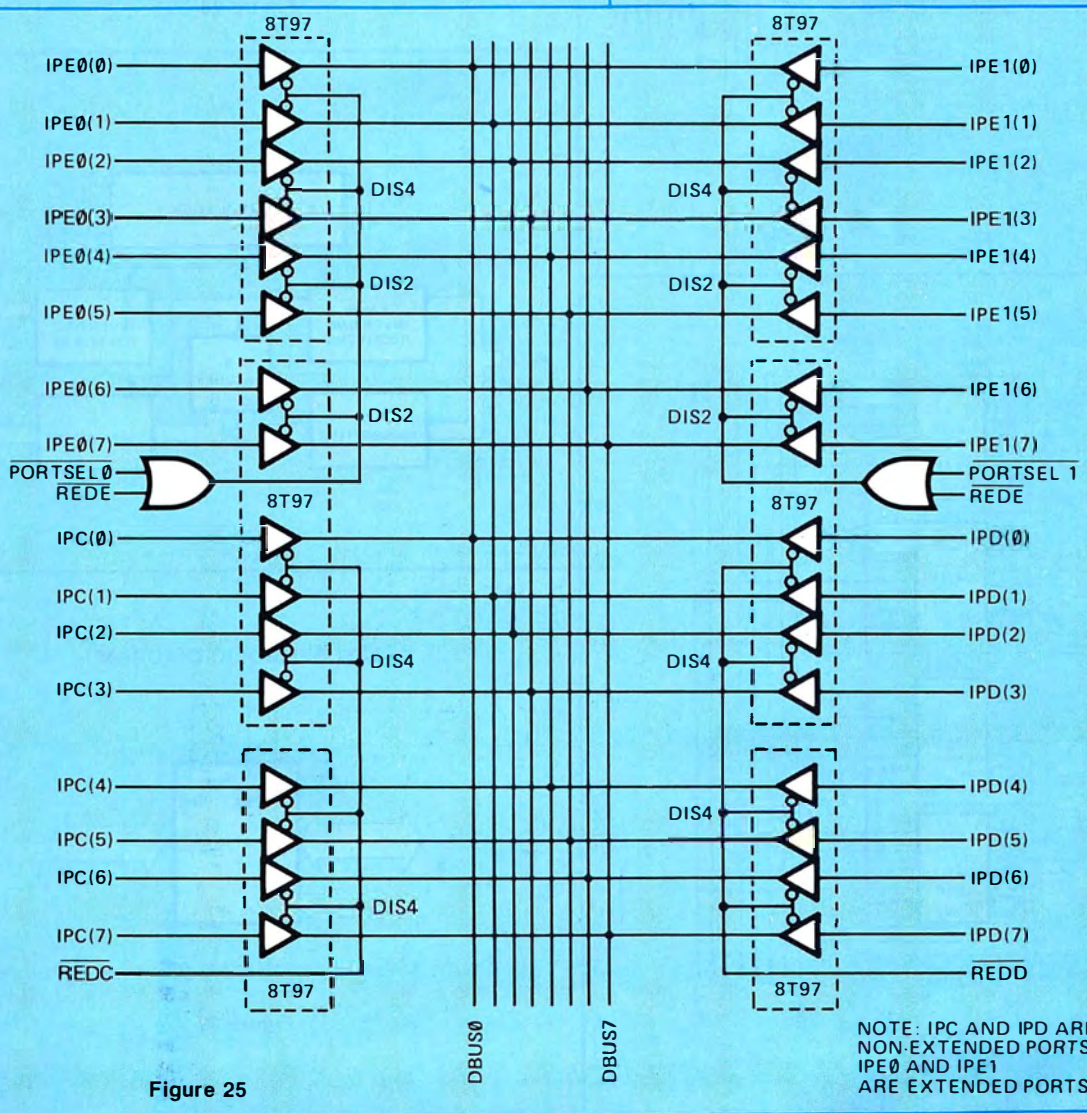


Figure 25

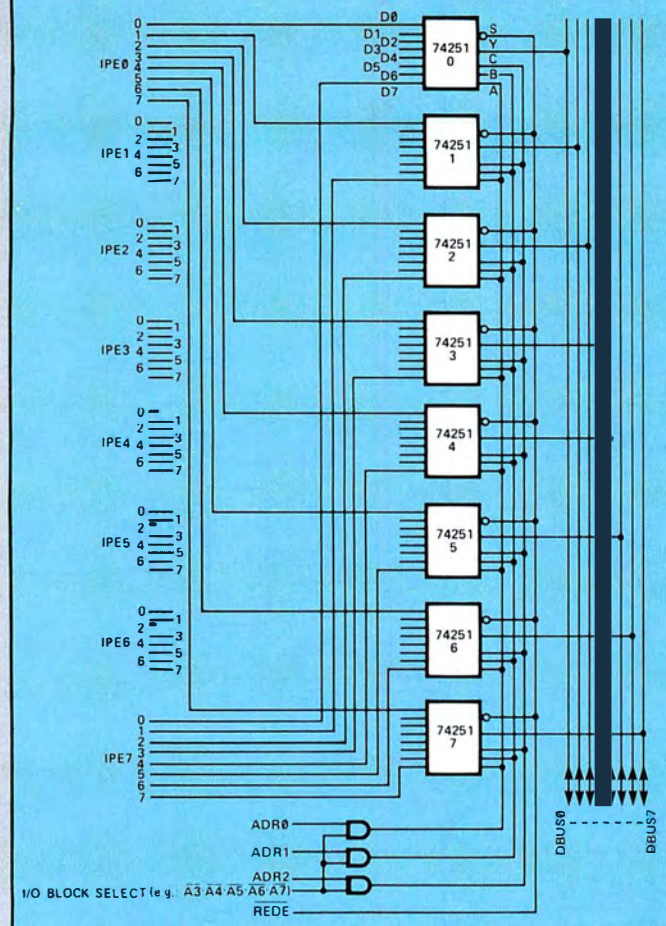


Figure 26

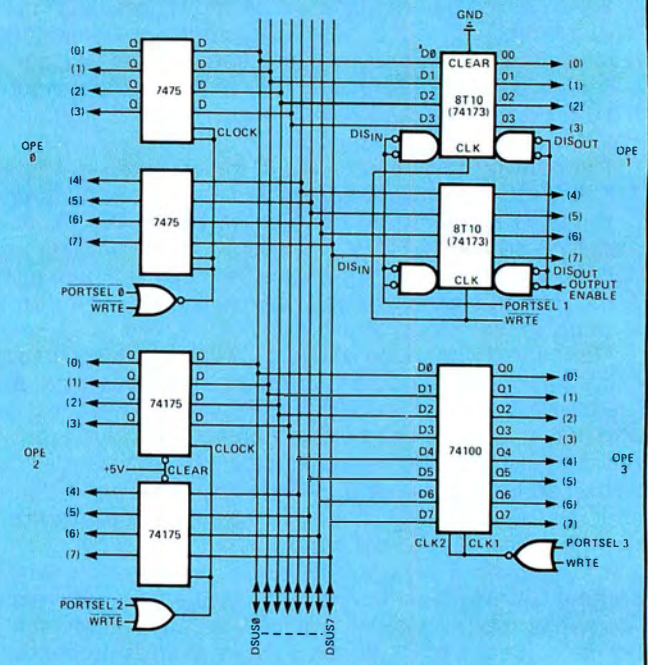


Figure 28

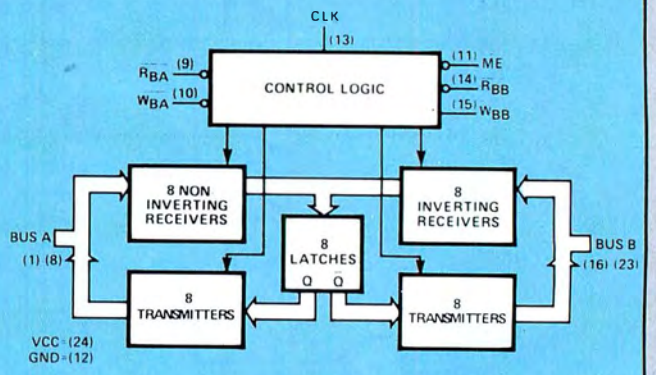


Figure 29

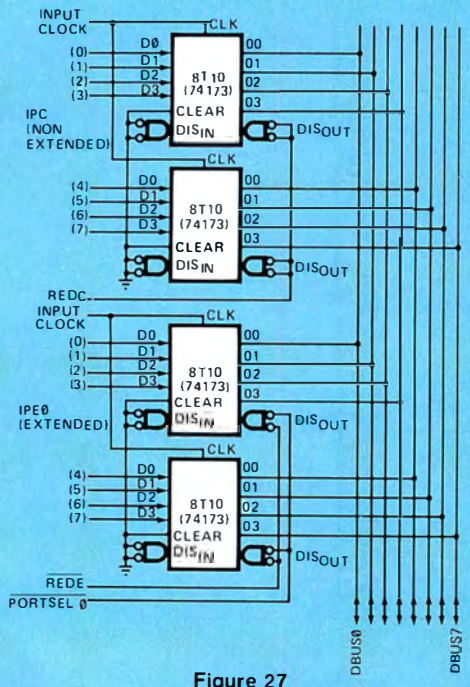


Figure 27

8T31 SYMBOLIC DIAGRAM

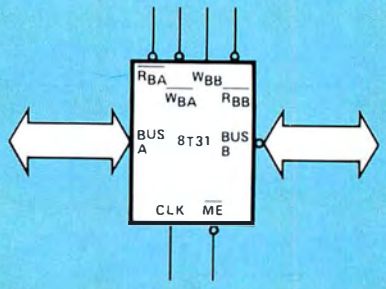


Figure 30

THE 8T31 USED AS A GATED INPUT PORT, LATCHING INPUT PORT, OUTPUT PORT, AND DATA BUS DRIVE

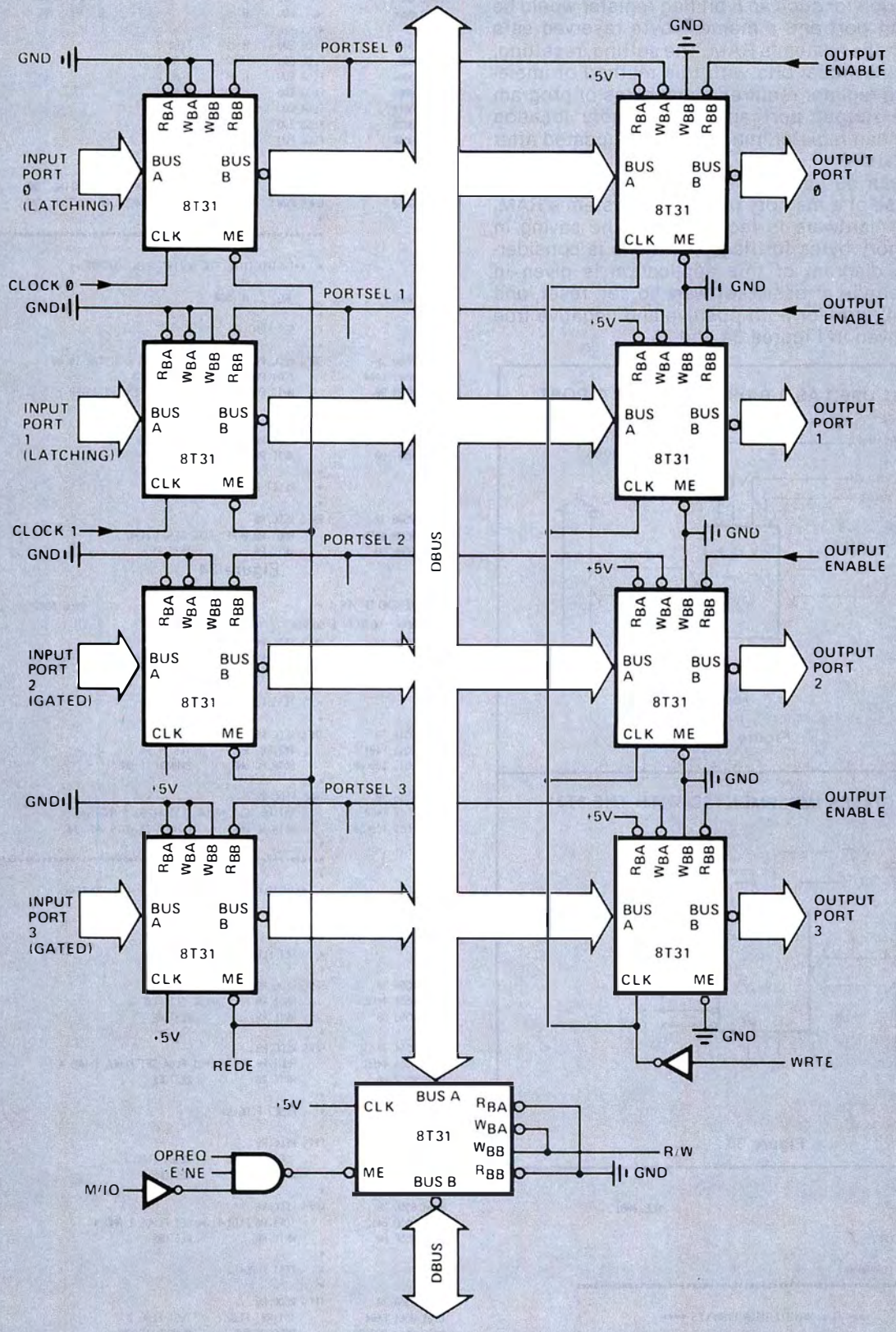


Figure 31

write operations from peripheral and CPU. The bidirectional I/O port concept is illustrated in Figure 32.

In many industrial applications, such as process control, single bit inputs and outputs are used to monitor switches and detectors or to drive relays and lamps. A possible solution for such an 8-bit flag register would be an 8-bit output port and a memory byte reserved as a flag register in the system's RAM. The setting, resetting, or testing of individual bits with this method of implementing a flag register requires many bytes of program memory. The output port and the memory location reserved as a flag register image must be updated after each bit operation.

The 8T31 can be used to implement a flag register without the use of a memory byte in the system's RAM. No additional hardware is required, and the saving in program memory bytes for flag operations is considerable. A logic diagram of this application is given in Figure 33. Listings of basic software to set, reset, and test individual flags for both positive and negative true outputs are given in Figures 34 and 35.

THE 8T31 USED AS A BIDIRECTIONAL I/O PORT

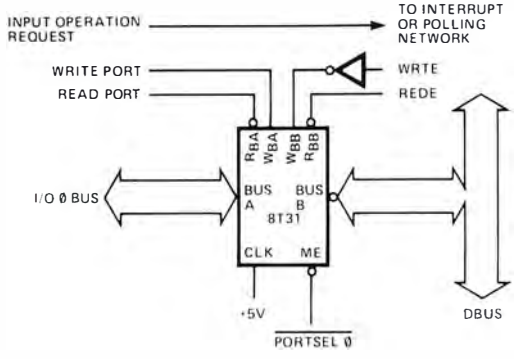


Figure 32

A FLAG REGISTER IMPLEMENTED WITH THE 8T31

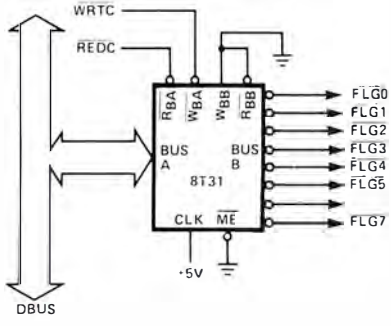


Figure 33

```
TWIN ASSEMBLER VER 1.0                                  PAGE 0001

LINE ADDR  OBJECT  E SOURCE

0001               * P07680B0
0002               ************************************************
0003               *                                              *
0004               *     **** FLAG MANIPULATION EXAMPLES ****     *
0005               *                                              *
0006               * THIS LISTING GIVES SOME EXAMPLES HOW TO SET, RESET  *
0007               * AND TEST INDIVIDUAL BITS OF AN EXTERNAL FLAG REGISTER
0008               * BUILT WITH THE 8T31 BIDIRECTIONAL I/O PORT   *
0009               * INSTRUCTIONS ARE GIVEN FOR BOTH ACTIVE 'HIGH' AND   *
0010               * ACTIVE 'LOW' OUTPUTS                         *
0011               *                                              *
0012               ************************************************
0013               *
0014               * DEFINITIONS OF SYMBOLS
0015               *
0016 0000          R0   EQU   0        PROCESSOR REGISTERS
0017 0001          R1   EQU   1
0018 0002          R2   EQU   2
0019 0003          R3   EQU   3
0020 0000          Z    EQU   0        BRANCH COND    ZERO
0021 0003          UN   EQU   3                       UNCONDITIONAL
0022 0000          AL   EQU   0                       ALL BITS ARE 1
0023               *
0024 0001          FLG0 EQU   H'01'    FLAG 0
0025 0002          FLG1 EQU   H'02'    FLAG 1
0026 0004          FLG2 EQU   H'04'    FLAG 2
0027 0008          FLG3 EQU   H'08'    FLAG 3
0028 0010          FLG4 EQU   H'10'    FLAG 4
0029 0020          FLG5 EQU   H'20'    FLAG 5
0030 0040          FLG6 EQU   H'40'    FLAG 6
0031 0080          FLG7 EQU   H'80'    FLAG 7
0032               *
0033 0600          ONE  EQU   H'0600'  DUMMY ADDRESS OF ROUTINE 'ONE'
0034 0650          ONES EQU   H'0650'  DUMMY ADDRESS OF ROUTINE 'ONES'
0035               *
0036               ************************************************
0037               *
0038               *  **INSTRUCTIONS FOR ACTIVE 'LOW' OUTPUTS**
0039               *
0040 0500               ORG    H'0500'
0041               *
0042               *    SET FLAG(S)
0043               *
0044 0500 50       SNFG REDC,R0          LOAD FLAG REGISTER IN R0
0045 0501 6404          IORI,R0 FLG2     SET FLAG 2
0046 0503 B0            WRTC,R0          RESTORE FLAG REGISTER
0047               *
0048 0504 30       SNFS REDC,R0
0049 0505 6460          IORI,R0 FLG5+FLG6 SET FLAGS 5 AND 6
0050 0507 B0            WRTC,R0          RESTORE
0051               *
0052               *    RESET FLAG(S)
0053               *
0054 0508 30       RNFG REDC,R0
0055 0509 44FB          ANDI,R0 H'FF'-FLG2 RESET FLAG 2
0056 050B B0            WRTC,R0          RESTORE
```

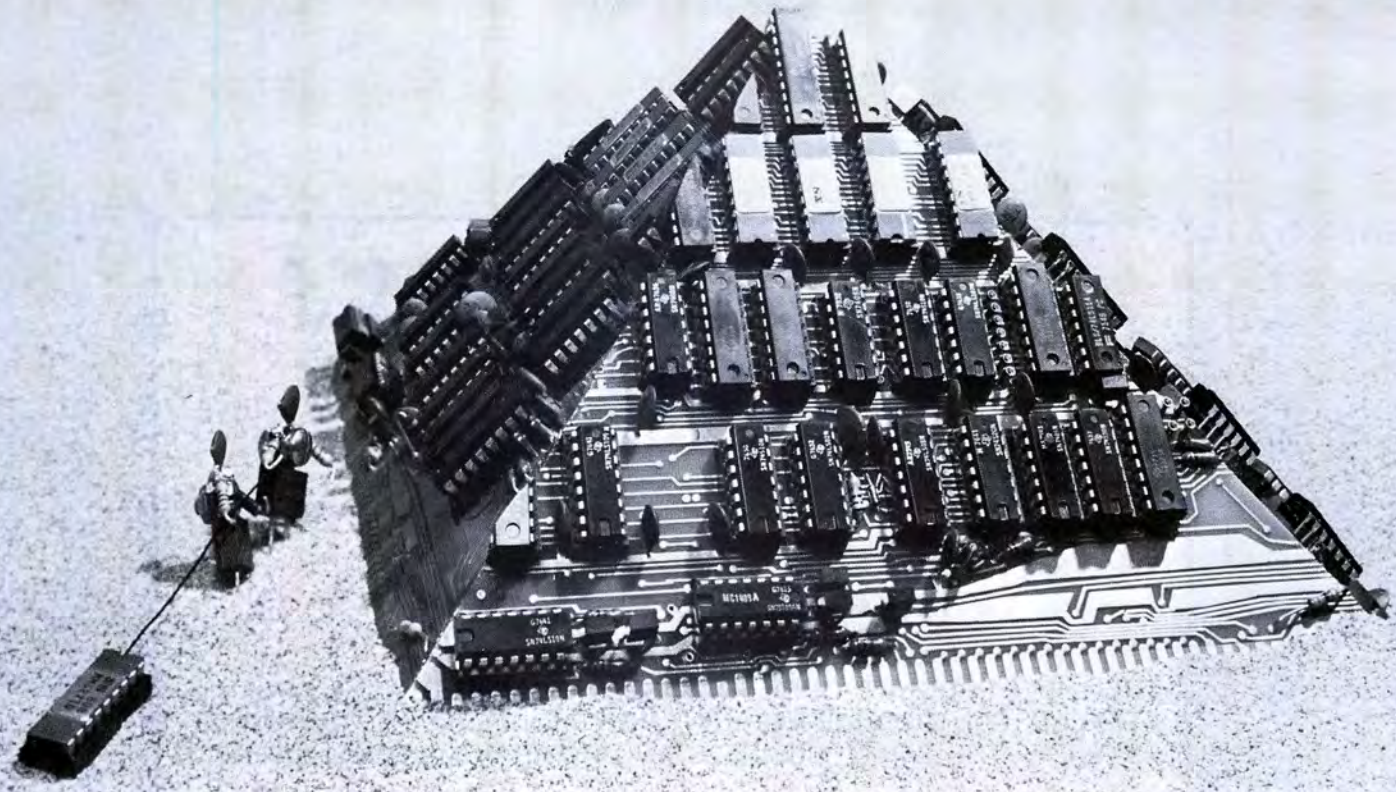
Figure 34

```
TWIN ASSEMBLER VER 1.0                                  PAGE 0002

LINE ADDR  OBJECT  E SOURCE
0058 050C 30       RNFS REDC,R0
0059 050D 449F          ANDI,R0 H'FF'-FLG5-FLG6 RESET FLAGS 5 AND 6
0060 050F B0            WRTC,R0          RESTORE
0061               *
0062               *    TEST FLAG(S)
0063               *
0064 0510 38       TNFG REDC,R0
0065 0511 F404          TMI,R0  FLG2     TEST FLAG 2
0066 0513 1C0600        BCTA,AL ONE      BRANCH IF ONE
0067               *
0068 0516 30       TNFS REDC,R0
0069 0517 F460          TMI,R0  FLG5+FLG6 TEST FLAGS 5 AND 6
0070 0519 1C0650        BCTA,AL ONES     BRANCH IF BOTH ARE ONE
0071               *
0072               ************************************************
0073               *
0074               *  **INSTRUCTIONS FOR ACTIVE 'HIGH' OUTPUTS**
0075               *
0076 051C               ORG    H'0550'
0077               *
0078               *    SET FLAG(S)
0079               *
0080 0550 30       SPFG REDC,R0
0081 0551 44FB          ANDI,R0 H'FF'-FLG2 SET FLAG 2
0082 0553 B0            WRTC,R0          RESTORE
0083               *
0084 0554 30       SPFS REDC,R0
0085 0555 44ED          ANDI,R0 H'FF'-FLG1-FLG4 SET FLAGS 1 AND 4
0086 0557 B0            WRTC,R0          RESTORE
0087               *
0088               *    RESET FLAG(S)
0089               *
0090 0558 30       RPFG REDC,R0
0091 0559 6404          IORI,R0 FLG2     RESET FLAG 2
0092 055B B0            WRTC,R0          RESTORE
0093               *
0094 055C 30       RPFS REDC,R0
0095 055D 6412          IORI,R0 FLG1+FLG4 SET FLAGS 1 AND 4
0096 055F B0            WRTC,R0          RESTORE
0097               *
0098               *    TEST FLAG(S)
0099               *
0100 0560 30       TPFG REDC,R0
0101 0561 F404          TMI,R0  FLG2     TEST FLAG 2
0102 0563 9C0600        BCFA,AL ONE      BRANCH IF ONE
0103               *
0104 0566 30       TPFS REDC,R0
0105 0567 F412          TMI,R0  FLG1+FLG4 TEST FLAGS 1 AND 4
0106 0569 9C0650        BCFA,AL ONES     BRANCH IF BOTH ARE ONE
0107               *
0108 0000               END    0

TOTAL ASSEMBLY ERRORS = 0000
```

Figure 35



Dynabyte builds the Great Memory

We cut up a Dynabyte 16k dynamic RAM board and constructed this pyramid to illustrate an important point: Dynabyte designs and builds memory boards with the same unmatched engineering ability and technical skill that went into Egypt's Great Pyramid.

One of the seven wonders of the ancient world, the Great Pyramid has been standing on the desert for an incredible 4,400 years. Although its enormous base covers 13 acres, it is perfectly square. Rising 450 feet, it is as tall as a 37 story building. Over 2.3 million blocks of stone were used, each averaging 2½ tons. Some weigh 16 tons. Despite their size, they fit together with a tolerance that is less than half the width of a human hair.

Dynabyte builds its 16k dynamic RAM boards with the same exceptional precision and care. Their reliability is as solid as a rock.

Dynabyte's design meets rigid industrial grade standards. The design is so good, in fact, that one of the largest, most experienced electronics manufacturers has tried to imitate it. (We were flattered but not surprised; we know how good it is.)

More than 1400 microcomputer owners also know how good it is. Dynabyte's 16k dynamic is running in more systems than any other dynamic memory on the market.

We select the best components we can buy to build the 16k dynamic, because solid parts make a solid memory. Our memory chips, for example, are factory prime from National Semiconductor.

Dynabyte was the first to deliver 16k dynamic RAM's assembled, tested and burned in. And at a price competitive with kits! Each board's complete function is confirmed by three stages of testing and a burn in cycle that runs 72 hours at 70° C (158°).

When we build them that solid we can guarantee them for a full year.

If a Dynabyte board ever needs repair, we provide factory service with a 24 hour turnaround for both warranty and non-warranty work.

The Dynabyte 16k dynamic has the widest compatibility of any dynamic memory. So it will work in your system.

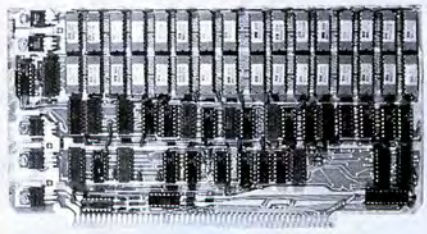
The Great Memory by Dynabyte is a solid buy. And an economical one. Effective October 1, the new Manufacturer's Suggested Price is reduced from $485 to $399.

Ask for the Great Memory by Dynabyte at your local computer store. If it isn't in stock, tell the owner that he missed another Dynabyte sale, and order direct. Telephone (415)494-7817. Cable DYNABYTE. Or mail to Dynabyte, Inc., 4020 Fabian, Palo Alto, CA 94303.

Specifications: 16,384 bytes, National Semiconductor MM5271 chips, S-100 compatible, 350 nsec. access time, 550 nsec. cycle time, transparent refresh, no wait states for 2 MHz 8080 processor, on board clock, 5 watts power consumption, 1 MHz direct memory access, 16k addressing, solder masked, assembled with sockets, tested, burned in, guaranteed one year.

Dynabyte

Builders of the Great Memory



NEW PRODUCT GUIDE

THIS NEW PRODUCT GUIDE HAS BEEN COMPILED AS A SPECIAL FEATURE TO INTRODUCE THE MANY NEW PRODUCTS AND COMPANIES ENTERING THE SMALL BUSINESS AND HOME COMPUTING MARKET.

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Microprocessor Kits

NCR 8000 Series

NCR Corporation's 8000 computer series now includes 11 models. Interactive systems include I-8230, I-8250 and the new I-8430, all of which provide progressively more powerful and compatible interactive, multiprogramming capabilities. N-mode members of the 8000 series (those systems compatible with the earlier NCR Century batch, on-line and multiprogramming systems) include the N-8350, N-8450, N-8560 and N-8570.

NCR 8000 series systems operating in the virtual mode include the V-8450, V-8550, V-8560 and V-8570.

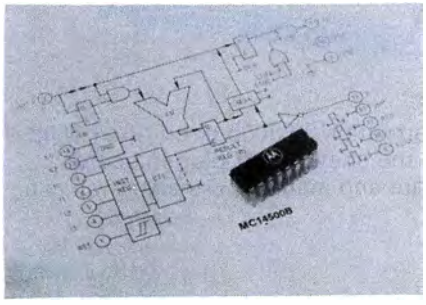
The series of compatible 8000 systems will be further expanded later this year with the introduction of the new top-of-the-line V-8500 systems, as well as the I-8100 family of microprocessor-based, interactive small business systems.

For further information contact NCR Corporation, Dayton, Ohio 45479, (513) 449-2150.

CIRCLE INQUIRY NO. 282

Digital Processing — One Bit at a Time

The MC14500B operates with a 16-instruction set. Five of the instructions control the boolean functions of the incoming signal and the stored signal; i.e., AND, AND-complemented, OR, OR-complemented and exclusive-NOR. The other eleven instructions control data transfers to and from the ICU and generate control signals.



The ICU is the monolithic embodiment of the central architecture of a Programmable Logic Controller (PLC). Like a PLC, the ICU has been optimized for looping (rather than jumping) program flow. By operating on inputs and outputs one-at-a-time and by utilizing a looping program flow, an ICU-based system offers a relatively simple approach to controlling electronic and electro-mechanical devices involved in decision-oriented tasks.

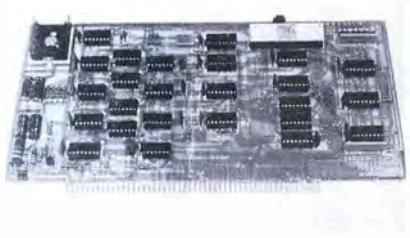
The ICU executes one instruction per clock cycle and operates from DC to 1.0 MHz (@ V_{DD} = 5 V). An oscillator circuit is contained on the chip. The four instruction inputs are TTL-compatible; the outputs can drive one low-power Schottky load or two low-power TTL loads. The ICU operates over a 3 VDC to 18 VDC range and features a typical noise immunity of 45% over that operating range. In addition to low current drain, (quiescent current drain is typically 5.0 μAdc @ V_{DD} = 5 V), the ICU is a B-Series device that is compatible with all Motorola CMOS products.

The circuit is offered in a 16 pin ceramic or plastic DIP. The 100-999 ceramic price is $7.58; availability is now, from the IC division (Austin, Texas facility) or from authorized Motorola distributors. For further information, contact CMOS Marketing, Motorola IC Division, 3501 Ed Bluestein Blvd., Austin, TX 78721.

CIRCLE INQUIRY NO. 101

Altair™ Z-80 CPU Board

Expand the capabilities of your Altair 8800 series microcomputer with the addition of an Altair Z-80 CPU Board from MITS. This innovative microprocessor offers an increased instruction set (158 instructions) which facilitates machine language programming.



The Altair Z-80 Board occupies one slot on the 8800 motherboard. It provides pertinent 8080 status, control and clock signals as well as the extended Z-80 instruction and addressing modes. Altair Z-80 Compatible BASIC, an independent programming language, and Z-80 Assembler, which runs under Disc Operating System (DOS), permit the most efficient use of your Z-80 microprocessor.

For further information contact MITS, Inc., 2450 Alamo S.E., Albuquerque, NM 87106.

CIRCLE INQUIRY NO. 102

Personal Computer/Calculator

Texas Instruments has introduced the SR 60A, a personal computer/calculator as the heart of a versatile business system that provides the power of a computer with the usage simplicity and low cost of a calculator.

An ideal problem solver for small businesses, the SR 60A uses a microprocessor to control an optional letter quality typewriter with full input/output capability for full page reports and multiple copy forms printouts. The microprocessor can also control up to two digital quality cassette tape drives with file management capability for on-line storage and retrieval of payroll records, inventory status, and sales orders. Serial communications capability is also available, allowing the SR 60A system to communicate with computers and many other devices. The SR 60A, which replaces the SR 60, has a suggested retail price from $1995.

For further information, contact Texas Instruments Incorporated, IAS, P.O. Box 53 (Attn: SR 60A), Lubbock, TX 79408.

CIRCLE INQUIRY NO. 103

S-100 Z-80 CPU Board

S-100, Inc., has introduced a new Z-80 CPU board for the S-100 bus. The board provides for power on jump capabilities to an on-board 1K or 2K monitor in EPROM.

Some control circuitry is also included on the board providing for a run or stop condition and for the generation of various wait states as required by slow memories. The board can be used with front panel or front panel-less systems and can be used for replacement in existing 8080 systems.

All IC sockets are provided and low power LS TTL ICs are utilized. The normal board is offered to run at a 2 Mhz speed to match existing S-100 bus structures. These boards are of exposy glass construction and featured plated-thru holes with full gold edge connector fingers. The 2Mhz version can be ordered in kit form for $119.95 or $169.95 fully assembled and tested. An optional 4 Mhz version with Z-80 hig speed CPU chip is available at $139.95 or $189.95 fully assembled and tested. Delivery is from stock.

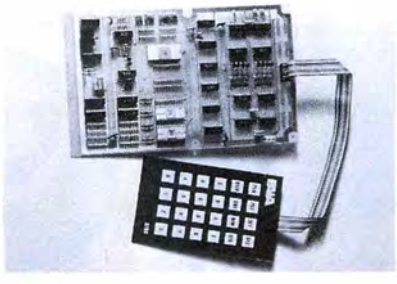
For details write or call S-100, Inc., 7 White Place, Clark, NJ 07066. (201) 382-1318.

CIRCLE INQUIRY NO. 104

PAiA 8700 Computer/Controller

The PAiA 8700 is an applications oriented 6503 based microprocessor system featuring 1K bytes RAM locations (512 bytes supplied), 1K bytes ROM locations (256 byte monitor included), two 8-bit input ports, two 8-bit output ports, one latched one buffered.

A 24 key touch operated keypad is used by the monitor to allow entry and execution of user programs and is also user definable. Two latched 7 segment displays are used by the monitor to display memory location and contents, easily user programmed.



A unique self-test feature allows all devices connected to the data bus to be broken loose simultaneously while at the same time forcing the MPU to execute a NOP instruction allowing easy monitor of proper (or improper) operation of the address bus.

An optional cassette interface is available ($22.50) that fits entirely on the processor board allowing the use of any audio cassette recorder for program storage.

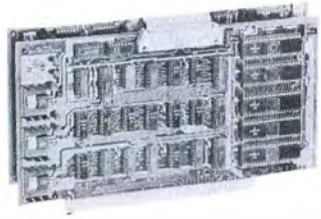
The PAiA 8700 Computer/Controller is available through full product line comptuer stores or direct from PAiA for $149.95 plus

THE COMPUTER PLACE

TORONTO, CANADA

Now Carries

ALPHA MICROSYSTEMS



AM-100 16-BIT CPU

The AM-100 by Alpha Microsystems replaces your 8080 microprocessor in the S-100 bus computer with a 16-bit microprocessor CPU (2 card set) that gives you Mini-computer power.

- Eight 16-bit multipurpose registers
- Multi-level DMA and vectored interrupt system
- Real-time clock on the CPU board
- Hardware-supported totally relocatable object code
- Multi-user, multi-tasking timeshared operating system
- True priority system in time-sharing operations
- Multi-user structured file system with passwords
- Multiple-pass macro assembler and linking loader
- Floppy disc file management system and utilities
- Up to 10 times the throughput of an 8080 system
- Fully supports most S-100 peripherals without modification
- AlphaBasic extended compiler and run-time system (not an interpreter)
- Free-form test editor and letter-writing text formatter
- System generation program to create custom operating system monitors
- Completely device-independent with logical file I/O calls

Introducing the AM-400 — an S-100 bus compatible hard disc pack storage group that ranges from 50 to over 1000 megabytes on a single controller. Average access time is 28 milliseconds for fast response for real-time manipulation of files. The controller supports up to four Calcomp Trident drivers which may each contain from 25 to 300 megabytes of storage. These drivers require no special environment for reliable operation with maintenance available in most parts of the United States.

MITS

Now you can buy an Altair™ 8800b or an Altair 680b computer right off the shelf. Altair plug-in boards, peripherals, software and manuals are also available.

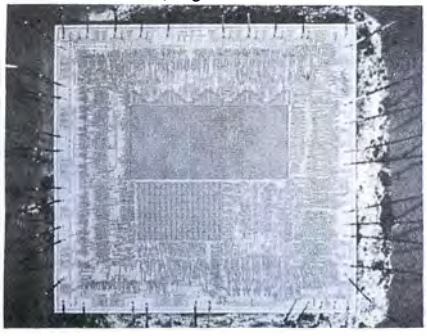
The Computer Place
186 Queen Street West
Toronto, Canada M5V 1ZI
(416) 598-0262
Telex: 06-22634

$3.00 postage and insurance. For further information contact PAiA Electronics, Inc., 1020 W. Wilshire Blvd., Oklahoma City, OK 73116.

CIRCLE INQUIRY NO. 105

S2000 4-Bit Microprocessor

The S2000 is a 4-bit microcomputer which is completely self-contained with ROM, RAM, processor and input/output on one chip. The program ROM contains 1024 bytes on-chip and is expandable to 8K words. Also contained on-chip is 256 bits of RAM, organized as 64 4-bit words.



The S2000 is designed to give access to all internal registers and memory for debug and test. The S2000 provides the advantages of computer architecture to low-cost, minimum parts-count, display/keyboard control systems. Sophisticated I/O and ROM expandability yield a cost-effective single-chip computer that functions like more expensive multi-chip microprocessors.

For further information contact American Microsystems, Inc., 3800 Homestead Rd., Santa Clara, CA 95051, (408) 246-0330.

CIRCLE INQUIRY NO. 107

Data-Trak

The increasing use of microprocessor sophistication in equipment serving the growing process control industry is typified by a process programmer developed by Research, Inc., using the Signetics 2650 microprocessor.

Known as the 5600 Data-trak, the process programmer provides automatic programming of temperature, pressure, flow, speed and position plus on/off events during the program cycle.

The 5600 Data-Trak provides single or dual analog outputs versus time, plus seven on/off programmable events. The programs are generated by straight line segments that fit the users' desired profile.

The microprocessor makes it possible to store and retrieve the program and to utilize a changeable program capacity, with up to 51 segments. Sense and flag bits are used to implement a low-cost TTY/Cassette interface for program storage. In addition, the company uses Signetics' compatible preprogrammed 2708 ultra-violet-erasable ROM circuits to allow for another 54 segments when a customer requires it.

For further information, contact Signetics, P.O. Box 9052, 811 E. Arques Ave., Sunnyvale, CA 94086, (408) 739-7700.

CIRCLE INQUIRY NO. MP1467

Number Cruncher CT200

The CT200 by Compu/Time is S-100 bus compatible and capable of doing high speed scientific mathematical functions in a task processing mode. The CT200, dubbed the NUMBER CRUNCHER, will enhance an existing microprocessor by plugging directly into the bus. It is a stand-alone number-oriented microprocessor (not a calculator chip) with its own on-board RAM that actually becomes part of main memory.

The Number Cruncher is completely under the control of the system processor. The Number Cruncher is a reverse polish notation microprocessing having its own microencoded instruction set that can perform algebraic, trigonometric, logarithmic functions as well as basic math, conditional and unconditional branching, INC and DEC instructions for iterative loops, I/O instructions with floating point or scientific notations.

The Number Cruncher contains a four register stack and has error flag generation and recovery. I/O data appears as ASCII to the system. Multiple Number Crunchers can be used in a single system. The CT200 comes assembled and tested and includes a comprehensive user manual. The price is $249.00 plus California tax and $2.50 shipping and handling. This unit is available from stock to 30 days and can be purchased from Compu/Time, P.O. Box 417, Huntington Beach, CA 92646, (714) 638-2094.

CIRCLE INQUIRY NO. 108

CPU-1

The CPU-1 is an 8080A CPU board made of double sided G-10 with gold plated edge connector fingers. When the vector interrupt circuit is built and the board is used in a computer equipped with a real time clock board and appropriate software, up to eight levels of priority vector interrupt can be utilized.

The documentation supplied with the board has photos of both the front and back of the board without solder mask and without parts so that all traces can be seen.

Prices are $30 bare (without parts); $185 kit; $220 assembled and tested. For further information contact WMC, Inc., 3107 Laneview Drive, San Jose, CA 95132.

CIRCLE INQUIRY NO. 106

Microcomputer Systems

Ebnek Mini-77

Ebnek, Inc. announces its fully assembled, low cost mini-computer providing the power of the 16 bit TMS 9900 processor. Savings were accomplished by limiting memory to 64K bytes; however, its compatibility with the larger System 77 allows upward expansion.

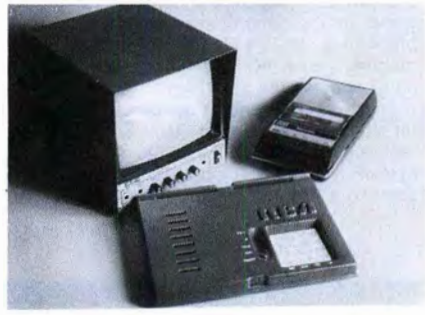
Both systems execute the same software including assemblers, editors, EASE (*E*bnek's *A*lgorithmic *S*ystem *E*ncoder), compilers and application programs. The Mini-77 has hardware to support a time-slicing, multi-task operating system.

The main-frame with parallel I/O, serial I/O ports, CPU, 16K bytes of RAM, an operating system residing in 4K bytes of EPROM, and cassette interface sells for $1770.00. For further information contact Ebnek, Inc., Box 164, Manhattan, KS 66502.

CIRCLE INQUIRY NO. 109

Hobby Computer Kit by RCA

An expandable, low-cost hobbyist computer kit, called COSMAC VIP — Video Interface Processor, is now available from RCA Solid State Division to permit the hobbyist to assemble a microcomputer with which he or she can create and play video games, generate graphics and develop microprocessor control functions.



Priced at $275.00 in kit form, the VIP is a complete computer on a printed circuit card, offering a powerful, uncluttered, complete operating system in only 4K bits of ROM.

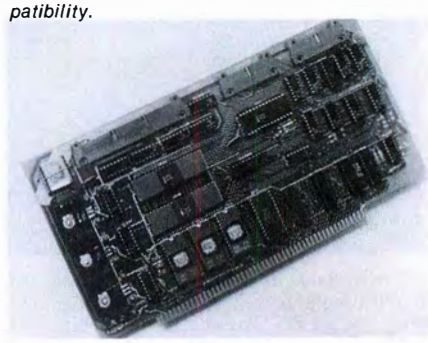
The easy-to-follow hobbyist's manual contains detailed information on kit assembly, operating procedures, programming technique, and much more.

Further information and order form may be obtained by writing to RCA Solid State Division, Box 3200, Somerville, NJ 08876.

CIRCLE INQUIRY NO. 110

Space Byte 8085 CPU

The SPACE BYTE 8085 CPU. A single card, self contained computer was developed specifically for the small business system packaged at the retail level. The Space Byte 8085 CPU, on one S-100 card, operates at 3MHz, using 450ns memory. It is 50% faster than the 8080 with *complete software compatibility.*



The Space Byte 8085 CPU is ideal for the small business computer system because of its full on-board I/O capability. There are two RS-232C serial I/O ports, with software selectable baud rates, one connects to a CRT, the other to a printer. There is a 22 bit parallel I/O port which interfaces directly with the iCOM 3700 series or Frugal Floppy Disk system.

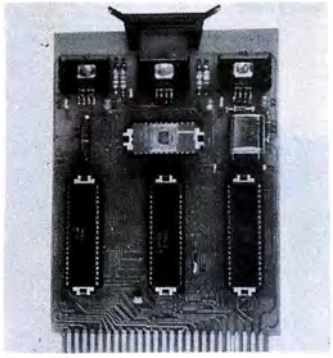
For further information contact The Space Byte Corporation, 1720 Pontius Ave., Suite 201, Los Angeles, CA 90025, (213) 468-8080.

CIRCLE INQUIRY NO. 111

CIRCLE INQUIRY NO. 38

LITTLE BIT

The Model 900-0 is a single card microcomputer having performance characteristics optimized for the requirements of bottom end applications where hardware simplicity, ease of application, and low cost are primary considerations.

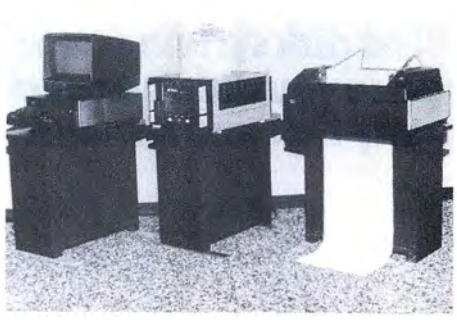


Complete software, firmware, training and programming services are available. Programs for assisting in software development for LITTLE BIT and the F8 microcomputer system are available nationally through a computer time share service. LITTLE BIT cards cost $125 each in 100 lots. Delivery is stock to seven weeks.
For further information contact Environmental Technology, Inc., 2821 W. Sample, South Bend, IN 46619, (219) 233-1202.

CIRCLE INQUIRY NO. 112

Z//100 Portable Microcomputer

A portable desk top computer designed for small business and industrial development system applications. Based on 8080 microprocessor technology the unit has up to 2 million characters of on-line floppy disc storage, up to 64K bytes of RAM, a Floppy Disc Operating System, On-line Text Editor, and resident ANSI FORTRAN IV* compiler.



Three versions of the Z//100 are available: the Z//100-1 with 34K bytes of RAM and two serial communication channels for customer supplied EIA or current loop serial CRT or hard copy terminal; the Z//100-2 which is the above unit with a 60-cps bi-directional printer with keyboard; and the Z//100-3 which is a Z//100 with a Teletype Model 40 CRT-KB and a 300 line per minute printer.

For further information contact Realistic Controls Corporation, 3530 Warrensville Center Rd., Cleveland, OH 44122, (216) 751-3158.

*FORTRAN IV distributed under license from Unified Technologies of Canada

CIRCLE INQUIRY NO. 113

System 8813

The System 8813 is a compact complete disc-based microcomputer. The central unit includes 16K bytes of RAM and room for three mini-floppy disc drives, in a walnut case with a brushed aluminum front panel. Included in the package is a video monitor, keyboard with cable, and complete system software on diskette.

System software allows you to put the system to work immediately, running applications in either assembly language or in fully extended BASIC. The small separate keyboard permits convenient use of the system at desk or table. Because it uses mini-floppy discs, the 8813 allows convenient storage and fast access to programs and data by means of simple user commands.

Prices start at $3250. For details on the system and applications library, write PolyMorphic Systems, 460 Ward Drive, Santa Barbara, CA 93111, (805) 967-0468.

CIRCLE INQUIRY NO. 114

Summa/11 Microcomputer System

The Summa/11, a new 16-bit personal computer from Interpring, combines the Digital Equipment Corporation's LSI-11 microprocessor with a floppy disc, extended disc BASIC, and an interactive operating system.

Omni BASIC features 32-bit integers, 15-digit floating point, extensive string manipulation capabilities, and virtual program storage to execute programs larger than available memory.

The Summa/11, including the LSI-11 processor, 24K bytes RAM, floppy disc, terminal inter-

The disk system you want at a price you didn't expect from a company that understands systems.

THE VISTA $50 FLOPPY DISCOUNT

We know that one of the biggest problems in personal computing is that you're buying with your own personal dollars.

That's precisely why you're going to like doing business with us.

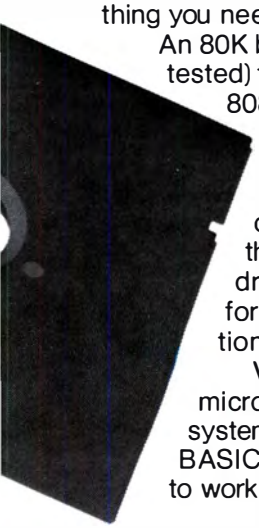
We're Vista Computer Company, the personal computer systems brainchild of the business computer systems people at Randal Data Systems.

And our V80 Floppy Disk System is a perfect example of how we're prepared to help you get the most out of your personal computing dollars.

$649 buys you the whole kit and kaboodle

The $649 you spend on a Vista V80 Floppy Disk System ($749 assembled) gets you everything you need:

An 80K byte minifloppy drive (assembled and tested) that can be powered directly by your 8080 or Z-80 computer. (Case and power supply optional.)



An I/O cable and a single card, S100 bus-compatible controller kit that handles up to four drives and includes a PROM for bootstrap loading (additional drives just $399).

VOS, the most advanced microcomputer disk operating system available, and our BASIC-E compiler, designed to work with VOS, all on a single diskette. Software functions include instantaneous program loading, named dynamic files, program editing, assembling, debugging, batch processing, and file copying on back-up diskettes.

All backed by the Vista 90-day warranty, membership in VUE (Vista Users' Exchange), and Dataforce, our associated service company with 115 locations throughout the country.

Test drive the V80 at your local computer store

Drop by your nearest computer store and run the V80 through its paces. Once you find out what it can do for you, you'll see that our combination of high performance and low price is hard to beat and easy to take.

We love to take orders

If you'd like us to ship you a Vista V80 Floppy Disk System, they're available now. Just send us a check or money order for the amount of purchase, or your BankAmericard/VISA or Master Charge account number with expiration date and authorized signature. California residents add 6% sales tax. Uncertified checks require six weeks processing.

To place your order, or to obtain further information, call or write today.

Vista Computer Company, 2807 Oregon Court, Torrance, CA 90503. (213) 320-3880.

Vista

We never forget it's your pocket.

face, power supply, enclosure and all software retails for $4,495 fully assembled and tested ($3,995 until December 1). For further information contact The Interpring Group, Inc., 50 Hunt St., Watertown, MA 02172, (617) 926-1510.

CIRCLE INQUIRY NO. 115

TRS-80 Microcomputer

The Radio Shack TRS-80 Microcomputer System is not a kit, the TRS-80 comes completely wired and tested, ready to plug in and use.

The TRS-80 System consists of a 53-key professional-type keyboard and microcomputer plus regulated power supply, a computer-controlled data cassette recorder and a 12" video display monitor.

The Radio Shack TRS-80 Microcomputer System is priced at $599.95, complete with video display monitor and data cassette recorder. The microcomputer alone is available for $399.95. For further information, contact Radio Shack, 2617 W. 7th St., Fort Worth, TX 76107, (817) 390-3272.

CIRCLE INQUIRY NO. 116

Challenger III

Challenger III contains a triple processor CPU board that can run virtually all published software available today for microprocessors at a very small cost increase over comparable single processor computers. Equipped with three microprocessors, Challenger III runs 6800, 6502, 8080 and Z-80 programs.

Challenger III comes standard with the OS-65D Disk Operating System and is ideal for educational applications. Students can study the three microprocessors for programming and engineering analysis.

Challenger III is fully compatible with all Challenger hardware and software. Further information is available from Ohio Scientific, 11681 Hayden, Hiram, OH 44234.

CIRCLE INQUIRY NO. 117

Challenger IIP

Challenger IIP is a personal computer complete with BASIC in ROM and RAM (4K) for programs in BASIC. All you have to do is turn it on and go!

Challenger IIP is a fully self-contained personal computer with a full size keyboard and a 32 x 64 Character Video Display Interface.

Complete with an Audio Cassette Interface, the Challenger IIP user simply connects a video monitor or home TV set via an RF converter (not supplied) and optionally a cassette recorder for program storage.

Challenger IIP comes complete with a 4 slot backplane and case for $598 fully assembled, and is expandable via compatability with all Ohio Scientific Computer Accessories. For further information, contact Ohio Scientific, 11681 Hayden, Hiram, OH 44234.

CIRCLE INQUIRY NO. 118

M68-MBC Microcomputer

Designed especially for the OEM the M68-MBC Microcomputer System comes complete with Hex Keyboard, 6 Digit Hex Display, Monitor Program, General Purpose Board, 4-Slot Mother Board and flexible Mounting System.

The main computer board will accept up to 768 words of RAM, 2.5K of PROM (with optional PROM adapter) and TTY/CRT/Cassette Interface.

The on-board monitor program allows inspect and change, load user's program, run user's program and break points. The integral key board and display make final system analysis and trouble shooting extremely simple. Price is $695.00. Available from stock.

For further information, contact Electronic Product Associates, Inc., 1157 Vega St., San Diego, CA 92110, (714) 276-8911.

CIRCLE INQUIRY NO. 119

TOTAL

The TOTAL Microcomputer System, for use in stand alone applications, consists of a M6800 processor with up to 52K bytes of RAM and an 80 by 25 CRT display monitor, a matrix line printer and a dual floppy disc.

The TOTAL Microcomputer System allows the user to program in Extended Disc BASIC language or to use a Disc Operating System software which features a Macro-Assembler, Editor, I/O handlers and variable length files.

Software applications available for the INEX computer include General Ledger Accounting with payroll and inventory, mailing list update and printing of address labels and form letters.

For further information contact INEX, Inc., Microcomputer Sales Office, 150 South 600 East, Salt Lake City, UT 84102. (801) 363-1177.

CIRCLE INQUIRY NO. 120

Development System with 300K Bytes of Floppy Disc Memory Storage

The Zilog compact Program Development System — the Z80-PDS — provides complete support for developing and debugging Z80 microcomputer programs.

Selling for $2,850 in single quantities, the standard Z80-PDS includes a floppy disc drive with up to 300,000 bytes of on-line data storage, internal memory of 3,000 bytes of PROM and 16,000 bytes of RAM, and Serial I/O with RS-232 or strappable current loop interface.

Providing low-cost software development capability, the Z80-PDS is expandable to include I/O or terminal capability and can be used as an inexpensive general-purpose computer. For more information, contact Zilog, Inc., 10460 Bubb Road, Cupertino, CA 95014, (408) 446-4666.

CIRCLE INQUIRY NO. 121

Data-Byte Computer

Billings Computer Corporation has interfaced the Billings family of hard discs with its Data-Byte System 1 business and scientific computers.

The Data-Byte system is the first computer in the under-$25,000 price range to interface and offer the 50 Megabyte and 80 Megabyte storage discs with removable disc packs.

A strong software package, including operation software and full, relocatable FORTRAN IV come as a standard part of the Data-Byte business and scientific systems.

Options that can be purchased along with the basic package include higher speed printers, X-Y plotters, A-to-D/D-to-A converters, acoustic couplers and application software.

For more information contact Billings Computer Corporation, P.O. Box 555, 2000 E. Billings Ave., Provo, UT 84601, (801) 375-0000.

CIRCLE INQUIRY NO. 122

10-Slot Tabletop Microcomputers

Electronic Control Technology's 10-slot tabletop microcomputers are of sturdy construction. The MB-10 mother board is S-100 bus and has a ground plane and resistive bus termination to reduce noise. The extruded channel rails are the same as used in the ECT-100.

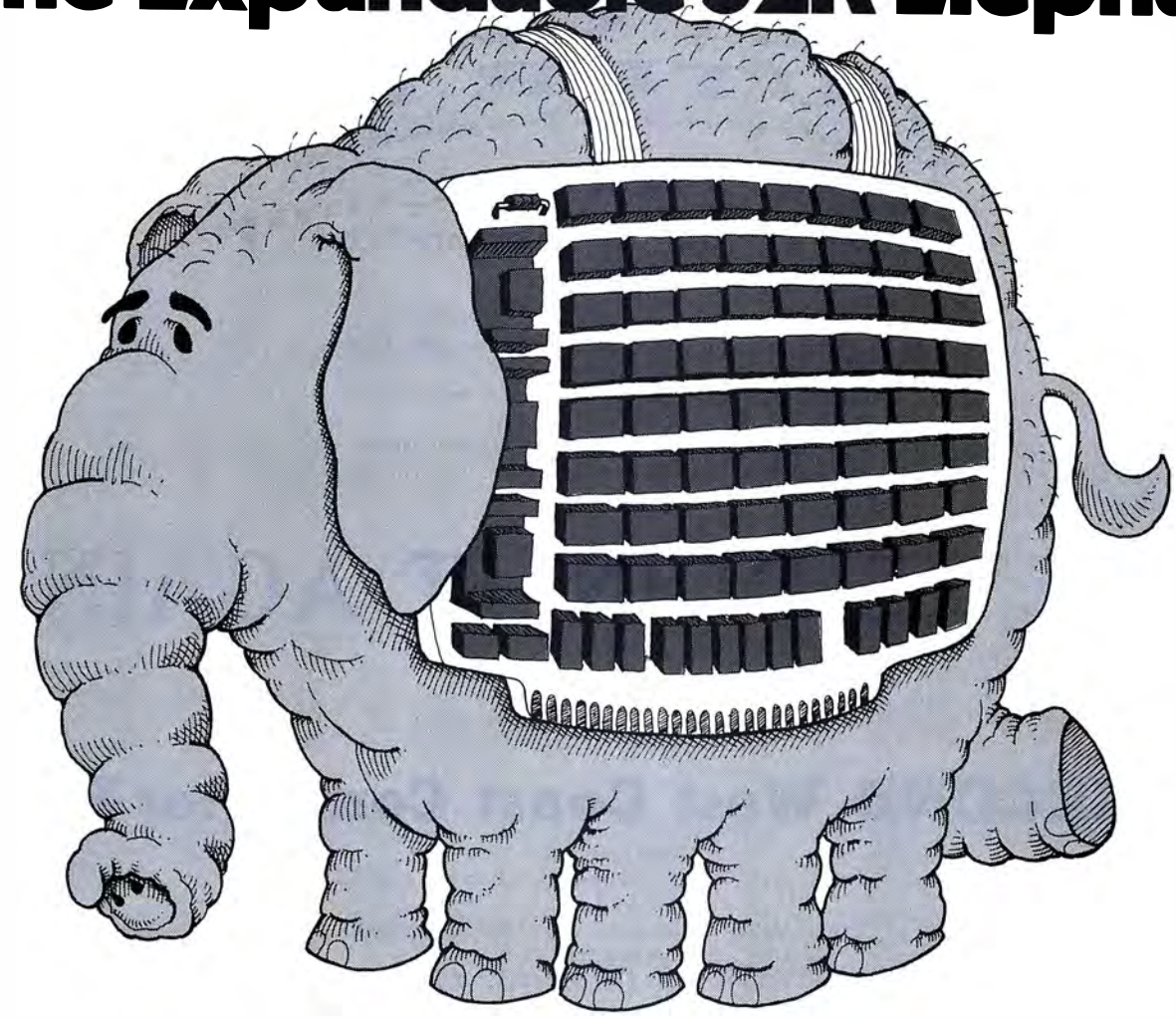
The tabletop microcomputers (TT-8080) consist of the enclosure, the card cage, the MB-10 mother board with a full set of 10 connectors and guides, the power supply, a whisper fan and a CPU board (8080 or Z-80) with 'JUMP' on Reset which does not require front panel controls except for a Reset pushbutton.

The tabletop systems (TT-8080-S) consist of the microcomputer with the addition of the 16K RAM board and an I/O board with a ROM monitor. Just add a CRT or other terminal for a functional microcomputer system.

TT-8080 kit price is $475; TT-8080-S kit price is $1,125. For more information contact Electronic Control Technology, P.O. Box 6, Union, NJ 07083, (201) 686-8080.

CIRCLE INQUIRY NO. 123

ARTEC Introduces
The Expandable 32K Elephant

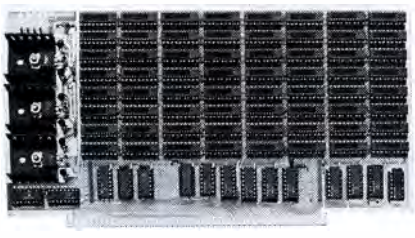


The 8K-32K Expandable Memory That Grows With Your System

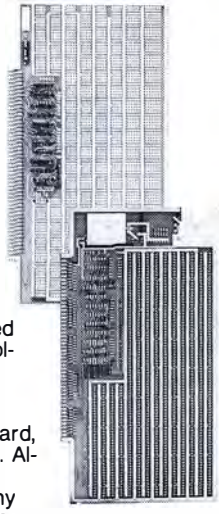
Now, for the first time, you can have a reliable true static memory that will grow with your system. Start with the board and 8K memory. Then add on one, two or three 8K increments of memory up to 32K. 250 ns access time. The Artec 32K Expandable Memory allows you plenty of room for memory and all necessary support hardware.

For five years Artec craftsmanship and reliability has been proven in tough industrial use. Now, you too can enjoy breadboards and memories that will work time after time. Boards like the GP 100 and the wire wrap WW-100. Send for an Artec Board, your order will be sent the same day as received.

Board & 8K of memory—$290.00
8K add on kits—$255.00 ea.
Full 32K board—$1,055.00



GP-100—$20.00
Maximum design versatility along with standard address decoding and buffering for S—100 systems. Room for 32 uncommitted 16 pin IC's, 5 bus buffer & decoding chips, 1 DIP address select switch, a 5 volt regulator and more. High quality FR4 epoxy. All holes plated through. Reflowed solder circuitry.



WW-100—$20.00
A wire wrap breadboard, similar to the GP 100. Allows wirewrap of all sizes of sockets in any combination. An extra regulator position for multiple voltage applications. Contact finger pads arranged for easy pin insertion.

TO ORDER: Use your Mastercharge or BankAmericard. Or just send along a money order. Your order will get same day service.

FOR MORE INFORMATION: For more information about these or any of Artec's complete line of circuit boards or for either industrial or personal use, please call or write. A catalogue will gladly be sent.

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A CALL FOR SPEAKERS

WEST COAST COMPUTER FAIRE

A Conference & Exposition on

Personal & Home Computers

You read about the FIRST West Coast Computer Faire
in
Byte, Interface Age, Kilobaud, Personal Computing, etc.
held in San Francisco last April
▪ 13,000 People ▪ 200 Exhibitors ▪ 100 Speakers
over 320 pages of published *Conference Proceedings.*
Well. . .

WE'RE DOIN' IT AGAIN

The SECOND West Coast Computer Faire

will be held in
The Brand New **Convention Center** in **San Jose**
in the
middle of "Silicon Valley" – the south end of the San Francisco Peninsula
expecting
▪ 10,000-15,000 People ▪ 50-100 Speakers ▪ 150-190 Exhibitors

March 3 - 4 - 5 1978

9am-6pm 9am-6pm Noon-5pm

(That's right after Compcon concludes in San Francisco)

YOU Can Be A Part Of It:

▪Talk about your latest project
Write *now* for speaker's instructions
Conference talks will be published

▪Exhibit homebrewed system
Prizes for best "homecooking"
(just like an old county fair)

▪Organize & chair Conference Section
Help gather speakers *you* want to hear
Assure the Conference has topics that interest *you*

Talks to be included in the published **Conference Proceedings** *must arrive by January 2, 1978, in the required format.*

Some of the **Conference Sections** being planned:

- Tutorials for computer novices
- Speech synthesis & speech recognition
- Computer-driven & computer-assisted music systems
- Computer graphics & video art
- Personal computers for the physically disabled
- Manufacturer tutorials on explicit systems
- Personal computers for education
- Business systems using "home" computers
- Computers & amateur radio
- Hardware & software design & implementation
- Standards for hardware, interfaces & software
- Workshops for club leaders, retailers, NL editors, etc.

Quick! **Write for more details:**
Computer Faire, Box 1579, Palo Alto CA 94302

SPEAKERS' PAPERS' DEADLINE: JAN. 2

Peripherals

Alphanumeric Printer MP 580

The Printer MP 580 is a serial printer; printing is performed from left to right by a mobile head with 7 printing electrodes; the character is printed on the paper by a dot matrix generated by the control logic.

The printing process is of the non-impact type on metallized, electrosensitive paper on which the printed characters are permanently recorded. In the case you will find — for special interfaces — a printed circuit for up to 24 wire wrap-sockets.

Input/Output levels are TTL/CMOS compatible fan out 2 Standard TTL. Print command is DC coupled low to high.f Input data is 6 bit parallel column serial according to ASCII code. Address output is 6 bit binary coded positive logic (for parallel interface). Other signals include busy, blank, data request, end of line. The MP 580 also has a signal connector 32-pin DIN 41612.

For further information contact Gertsch Brutsch AG, Hertistrasse 25, CH-8304 Wallisellen, Switzerland.

CIRCLE INQUIRY NO. 124

Off-Line Recorder "Silent 700" Terminals

The Memodyne ANSI Compatible Recording System Model 2146 is a compact, write only recorder that lets you record off-line at remote sites and times to free up a terminal. It accepts serial data at five selectable rates up to 1200 baud and records in ANSI/ECMA format. It will also accept parallel data. Standard Phillips cassettes are used and may also be read back on a Memodyne 3765-8 recorder.

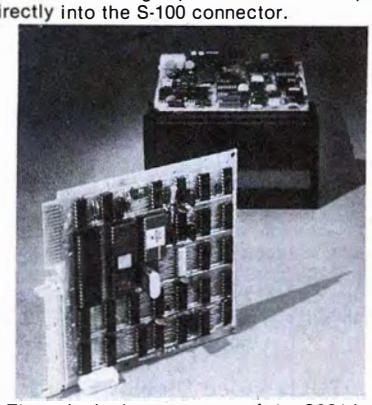
The Model 2146 stands alone, has easy-to-use front panel controls, in-out connectors, power supplies and carrying case. The unit measures 10½" x 7" x 11½", weighs ten pounds and operates on 110V AC 50-60 Hz; 220V AC optional. Baud rates are 110, 150, 300, 600 and 1200.

The Memodyne ANSI Compatible Recording System 2146 sells for $1725. For more information, contact: Memodyne Corporation, 385 Elliott St., Newton, MA 02164, (617) 527-6600.

CIRCLE INQUIRY NO. 125

LSI-Based Controller with S-100 Compatibility for Micro-Diskette Drives

The Wangco 8201 Micro-Controller™ provides a general purpose host interface for use in 6800 and 8080 based microcomputer systems, minicomputers and other byte oriented systems. One version of the 8201 is pin compatible with the industry standard S-100 bus. A single printed wire board plugs directly into the S-100 connector.



The principal component of the 8201 is the new Intel MCS 8048, a state-of-the-art microprocessor providing 1K of ROM, RAM and I/O ports on a single chip.

Less than 30 ICs are used, therefore, the controller size is a compact 5½" square.

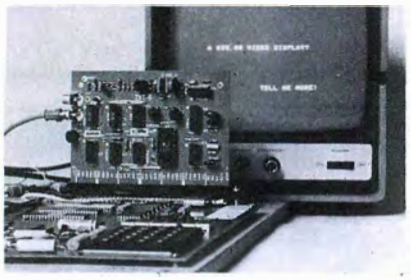
The Wangco 8201 will control up to four drives. Price: $490.00 in single unit quantity OEM discounts available. Delivery: 30 days ARO. For further information contact Wangco Inc., 5404 Jandy Place, Los Angeles, CA 90068, (213) 390-8081.

CIRCLE INQUIRY NO. 126

TVT-6 Direct Video Display

TVT-6 provides software controllable options including: Scrolling; over 2K on-screen characters with only 3MHz bandwidth; full performance cursor; variety of line/character for-

mats including 16/32, 16/64, even 32/64; user selectable line lengths and more for only $35.00 in kit form from PAiA.



An instruction manual for the TVT-6 including full operational details is also available from PAiA for $1.00 postpaid. For more information contact PAiA Electronics, Inc., 1020 W. Wilshire Blvd., Oklahoma City, OK 73116.

CIRCLE INQUIRY NO. 127

TDL's Video Display Board

Technical Design Labs has introduced the Video Display Board (VDB), a video interface for the S-100 Bus microcomputers.

The VDB consists of two boards, one piggybacked to the other. The unit occupies one edge connector on the bus, but takes up the space of two boards.

The VDB contains its own display buffer memory and provides two pages of display, each with 25 rows of 80-characters. The VDB works with either modified TV set or monitor and has an on-board 8-bit parallel keyboard port with status strobes.

The VDB is priced at $349 in kit form and $449 when assembled and tested. Software character and graphics output drivers for Z80* and 8080 systems are supplied.

For additional information, contact Technical Design Labs, Research Park, Bldg. H, 1101 State Road, Princeton, NJ 08540. (609) 921-0321.

*Z80 is a registered trademark of Zilog

CIRCLE INQUIRY NO. 128

24 x 80 Video Display Module

Celetron Data announces a unique video display module which includes a Byte Standard (Kansas City) audio cassette interface as well as a bi-phase cassette interface usable with audio recorders at 2400 baud and up, and with digital cassette recorders at baud rates limited only by the capabilities of the media. The video board has on-board 1K of RAM in the form of state-of-the-art 1K x 4 static and operates as 1K of system memory. It is supplied in either 24 lines x 40 or up to 12 lines x 80 format (readily changeable with a jumper change and a component substitution).

Instead of making use of conventional ROM character generators, the character set is stored in a bi-polar PROM, permitting either the user or the manufacturer to customize the character set. For example, an APL version will be offered by the manufacturer.

Other versions will be introduced in the very near future, specifically for the Intel SBC bus structure, and another board is planned for use with Heathkit H8 8080 systems.

For further information contact Celetron Data, P.O. Box 6215, Syracuse, NY 13217. (315) 422-6666.

CIRCLE INQUIRY NO. 129

Model 200 MINIDRIVE™

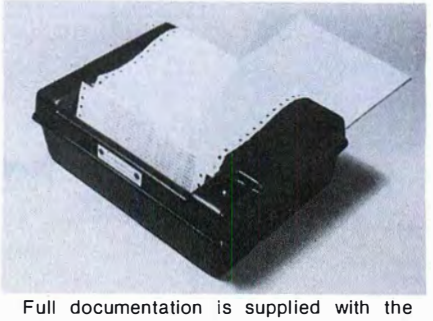
North Atlantic's Qantex Division announces the Model 200 MINIDRIVE™ storage module, which is a low cost, super compact and highly reliable tape transport for the 3M Company's recently developed Model DC100A miniature Data Cartridge. The transport, which forms the basic electromechanical building block for OEM data storage systems, measures only 3" x 4" x 4⅛" with cartridge in place, weights about one pound, and stores up to 720,000 bytes of unformatted data on the cartridge's 140-feet of magnetic tape.

The new Model 200 Minidrive™ is available in quantity within about 4 weeks from receipt of order. The associated electronic printed circuit boards have roughly the same delivery schedule. In single quantity, the single track version of Model 200 lists for $250.00. The highest-performance version lists single for $350.00. For further information contact North Atlantic Industries, Inc., Qantex Div., 200 Terminal Dr., Plainview, NY 11803, (516) 681-8350.

CIRCLE INQUIRY NO. 130

Black Box Printer for the Computer Hobby Market

The BLACK BOX Printer is a low cost ($396.00), fully assembled, 80 column, 10 character per second impact printer. Utilizing a print cylinder (not a dot matrix) containing a 64 ASCII character set, up to three copies are possible on tractor (or pressure) fed 8½" wide paper.



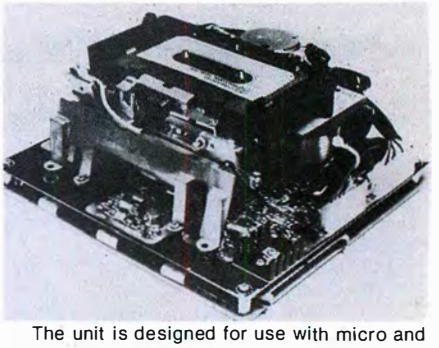
Full documentation is supplied with the printer including trouble shooting guides, installation and maintenance instructions, printer and interface schematics, plus instructions on how to wire up to the I/O parallel port.

The only option is the base and cover for $29.95. Otherwise, the printer is shipped complete — ready to connect and use. Detailed literature is available from Expandor, Inc., 612 Beatty Road, Monroeville, PA 15146, (412) 373-0300.

CIRCLE INQUIRY NO. 131

Triple i STR™-150 Cassette Program Storage and Retrieval System

Triple I gives you a low-cost way to incorporate a reliable remote-controlled magnetic tape recorder into your digital systems. This complete tape-drive unit provides full remote signal control of all transport functions. It includes read/write electronics, control and timing logic, and motor control logic. All you need to supply is a mounting location, power supply, and an interface with the controlling I/O devices.



The unit is designed for use with micro and mini computers, controllers, and other devices requiring remote control of the tape drive.

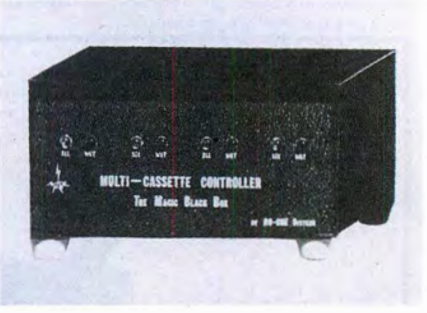
The patented Speed Tolerant Recording (STR) technique is used to achieve extremely high data reliability with standard low-cost digital cassettes. The technique also assures total STR-150 unit-to-unit tape compatibility as well as compatibility with all tapes recorded on any Triple i STR-type recorder.

For further information, write or call Triple I, 4605 North Stiles, Oklahoma City, OK 73118. (405) 521-9000.

CIRCLE INQUIRY NO. 132

The Magic Black Box

RO-CHE Systems now includes an I/O Driver for BASIC with their Multi-Cassette Controller, which controls up to four cassette recorders. This means that BASIC programs can read records from cassette tape and write records to cassette tape under program control.



The I/O Driver is patched to from BASIC and handles all input and output to either the cassette operating system or the console.

The Multi-Cassette Controller, which plugs into a single Tarbell interface board, comes in two models. The 4-port kit is $140.00 and the two-port kit is $110.00. Software included consists of the Cassette Operating System, BASIC I/O Driver and listing, Assembler with patches to assemble large programs from tape, Demo BASIC program and Demo record file.

Optional application software is available for text editing, formatting, sorting, merging, copying, etc. Please direct inquiries to RO-CHE Systems, 7101 Mammoth Ave., Van Nuys, CA 91405.

CIRCLE INQUIRY NO. 133

Integral Impact Printer

Full-performance, full-feature, dot matrix impact printer designed for use with mini or microcomputer systems prints at rates to 120 cps with up to 132 characters per line. The Integral Impact's standard features include an RS-232 and current loop serial interface, enhanced mode (double width) characters and selectable character and line sizes. Multiple copy capability on both fan-fold and roll paper is also a standard capability.

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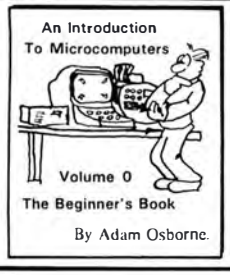
Many books on microprocessors and their use are now on the market, and most of them have names that sound alike. But Osborne & Associates' books have dominated this market since 1975, when our first book appeared. With rave reviews from all over the world — with more than five hundred university text adoptions, our books are all best sellers. In fact, "An Introduction To Microcomputers: Volume I — Basic Concepts" now holds the world's record in sales volume for any textbook sold for a profit.

If you want information on microprocessors, begin with the Osborne books.



"An Introduction To Microcomputers: Volume 0 — The Beginner's Book" By Adam Osborne.

This is the book for the absolute beginner. Assuming that you know nothing about computers, math or science of any kind, this book explains what computers are all about — and it takes you to the point where you can read Volume I. 300 pages.
Book No: 6001 $7.50

For the microcomputer user, a series of books provide complete programs, written in BASIC. All these books are by Lon Poole and Mary Borchers.

"Some Common Basic Programs" 200 pages.
Book No: 21002 $7.50

"Payroll With Cost Accounting — In Basic". 400 pages Book No.: 22002 $12.50

"Accounts Payable and Accounts Receivable"
Book No.: 23002 $12.50 Available November 30, 1977

"General Ledger System"
Book No.: 24002 $12.50 Available December 31, 1977

"An Introduction To Microcomputers: Volume I — Basic Concepts" By Adam Osborne.

The world's best selling textbook. This book explains, clearly, concepts common to all microcomputers, yet specific to none. 350 pages.
Book No.: 2001 $7.50

"8080A and 8085 Assembly Language Programming" By Lance Leventhal.

This book is for the assembly language programmer or student; it explains assembly language programming for the 8080A and 8085 microcomputers. The book contains numerous examples. 400 pages.
Book No.: 31003 $7.50 Available October 31, 1977

"An Introduction To Microcomputers: Volume II — Some Real Products" (Revised June 1977) By Adam Osborne, Susanna Jacobson and Jerry Kane.

This book describes every common microprocessor and all of their support devices. Information is new and clearly written. Only data sheets are copied from manufacturers. 1200 pages.
Book No.: 3001 $15.00

The "Programming For Logic Design" series of books show how to use microprocessors in a digital logic environment.

"8080 Programming For Logic Design" By Adam Osborne. 300 pages.
Book No.: 4001 $7.50

"6800 Programming For Logic Design" By Adam Osborne. 300 pages.
Book No.: 5001 $7.50

"Z80 Programming For Logic Design" By Adam Osborne and Susanna Jacobson.
Book No: 7001 $7.50 (Available November 30, 1977)

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Volume I — Basic Concepts (#2001)	$7.50 ea.	
Volume II — Some Real Products (#3001) revised 1977	$15.00 ea.	
8080 Programming For Logic Design (#4001)	$7.50 ea.	
6800 Programming For Logic Design (#5001)	$7.50 ea.	
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Some Common BASIC Programs (#21002)	$7.50 ea.	
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⬡ I require information on consignments, discounts and distributors outside the U.S.A.

Using the RS-232 serial interface, the printer can be integrated to any mini or microcomputer system by simply attaching it to a standard serial port.

Unit price for the Integral Impact is $745 with quantity discounts available. Delivery is 30-60 days ARO. For further information, contact: Integral Data Systems, Inc., 5 Bridge St., Watertown, MA 02172, (617) 926-1011.

CIRCLE INQUIRY NO. 134

RS232C Desktop Paper Tape Reader

DECITEK's desktop reader, designated Model 262D9, can be configured for desktop or rack mount with or without fan fold bins. Reading speeds are 0 to 300 characters per second bidirectionally and synchronously or asynchronously. RS232C connection, current loop and parallel I/O are all standard with this model.

Baud rates are selectable to 9600 baud. Interface characteristics are selectable by a DIP mode selection switch mounted on the rear panel, with additional program functions internally programmable by jumpers.

The new desktop reader incorporates all proven DECITEK design advantages, such as patented dual-sprocket drive, 25,000 hour light source with fiber optics and stepper motor drive. For further information, contact Decitek, 250 Chandler St., Worcester, MA 01602, (617) 798-8731.

CIRCLE INQUIRY NO. 135

EXORprint™

EXORprint is an economical, self-contained, impact printer subsystem, housed in an attractive table-top cabinet, intended for use with M6800 development systems. EXORprint is directly compatible with an EXORciser or Micromodule system.

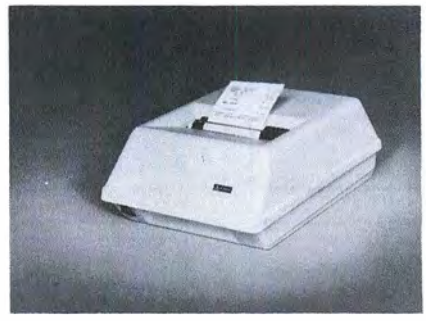
Adding an EXORprint to the combinatin of an EXORdisk (or EXORtape) and an EXORciser equipped with interface, memory and auxiliary modules brings 65-line-per-minute printing capability to complement the hardware and software generating power of the M6800 development system.

The unit price of this table-top sized printer is $1725.00 (110 Vac, 60 Hz version). EXORprint is available now, from the factory and from authorized Motorola distributors. For further information contact Motorola Microsystems at (602) 244-6815 or the Technical Information Center, Motorola Semiconductor Products, Inc., P.O. Box 20924, Phoenix, AZ 85008.

CIRCLE INQUIRY NO. 136

Mini/Microcomputer Printer

Ideally suited for terminal applications or as stand-alone printers, the DP-1000 Series Digital Printers feature a dot matrix impact printing element capable of printing 64 alphanumeric and special symbols in 40 characters per line at 1.25 lines per second on standard single or multiple-copy paper rolls.



Three basic ASCII configurations, conforming generally to EIA RS232-C, allow interfacing to most minicomputers, modems, and the current-drive mode to Teletype® printers. Standard baud rates from 110 to 2400 baud are available. All models have internal storage.

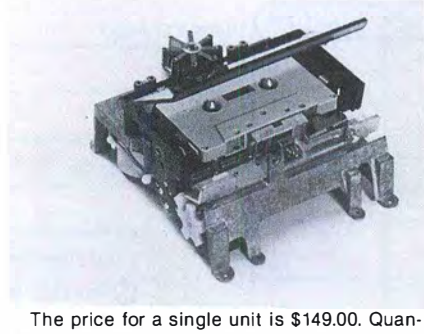
Single or double width characters may be selected via an external control line, allowing either 6 or 12 characters per inch to be intermixed on a line.

Prices for the DP-1000 Series start at under $700, with substantial dealer and OEM discounts offered. For complete details, contact Anadex, 9825 DeSoto Ave., Chatsworth, CA 91311, (213) 998-8010.

CIRCLE INQUIRY NO. 137

Phi-Deck® Cassette Transport

Triple I is adding a new fixed speed model with an AC capstan motor to its line of electronic cassette tape transports. Features of this model include four-motor control, remote control capabilities, fast start/stop, less than 30 seconds rewind, and speeds from 1 to 10 ips.



The price for a single unit is $149.00. Quantity pricing for 500 units is below $100.00.

The unit has applications in microprocessors, data recording/logging/storage, programming, instrumentation, industrial controls, data duplicating, security/automatic warning systems, testing apparatus, audio-visual education, hi-fi, and other general applicaitons.

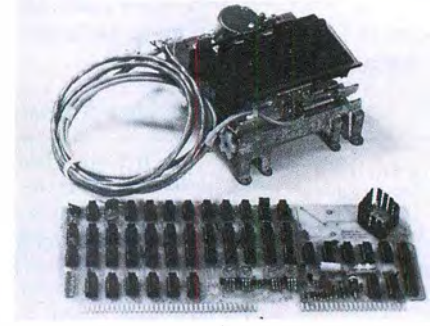
Control boards for the Phi-Deck are TTL, DTL, CMOS compatible and contain all the circuitry for proper control of the Phi-Deck tape transports.

For further information, write or call: Triple I, Inc., 4605 N. Stiles, P.O. Box 18209, Oklahoma City, OK 73118. (405) 521-9000.

CIRCLE INQUIRY NO. 138

GCR Cassette Storage System

The Triple I cassette storage system is a total magnetic tape data storage and retrieval system capable of controlling up to 4 Phi-Deck® cassette transports and accessing any of over one million 8-bit bytes within 20 seconds.



The system is ideal for general purpose data and program storage, file copying, editing, and sorting operations. Each deck is fully controlled to prevent tape breakage. Electronic braking precisely controls tape for fast forward and rewind operations. This system operates at 1600 flux changes per inch, yielding a data transfer rate of 800 bytes per second at a tape speed of five inches per second.

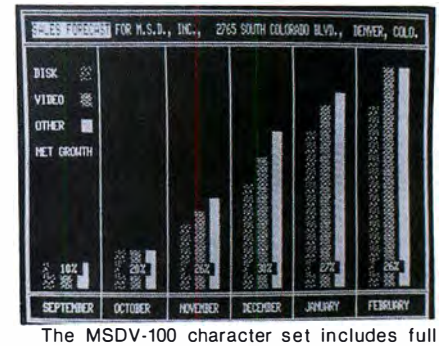
Single quantity price for the basic GCR system, which includes one Phi-Deck transport and one board for control and encoding/decoding, is $375.00. 250 quantity price is $295.95.

Extra decks and other quantity pricing are available from Triple I, 4605 N. Stiles, P.O. Box 18209, Oklahoma City, OK 73118. (405) 521-9000.

CIRCLE INQUIRY NO. 139

MSDV-100

The MSDV-100 Video Display System is a high quality 80 character, 24 line video output device for S-100 systems. Each of the 1,920 characters may be set under software control to blink, be underlined or be brighter than normal.



The MSDV-100 character set includes full upper and lower case ASCII, as well as a complete set of vertical and horizontal lines. In addition, nine levels of grey scale may be generated permitting easy display of charts, graphs, order entry forms, and animation.

The MSDV-100 Video Display System is available directly from MSD, Inc. at a price of $285 in kit form, $385 assembled. For further information call (303) 758-7411 or write MSD, Inc., 2765 S. Colorado Blvd., Denver, CO 80222.

CIRCLE INQUIRY NO. 140

MECA ALPHA-1 System

The MECA ALPHA-1 System is a cassette based mass storage system for S-100 bus computers. The System is offered with a powerful cassette operating system which supports a wide range of business, development and educational activities. Meca offers a stand alone operating system or one with Extended BASIC. Applications include mailing lists,

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Sanyo Monitors
G. Risk Keyboards

Cromemco
OK Machine / wire wrap
Continental Specialties / breadboard
Vector / wire wrap
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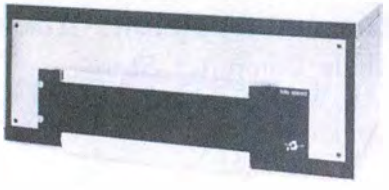
payroll, billing, inventory, program development and training system using unique audio capabilities.

A wide variety of system configurations are available which allow you to purchase only the amount of system required for your application. Prices start at $240 and units are available from stock. For more information contact Meca, 7026 O.W.S. Rd., Yucca Valley, CA 92284. (714) 365-7686.

CIRCLE INQUIRY NO. 141

Model 81 Printer

A new inexpensive dot matrix serial impact printer is being offered by Tele Speed Communicatinos, Inc., designed to meet the need of the microprocessor market or wherever inexpensive hard copy output is required.



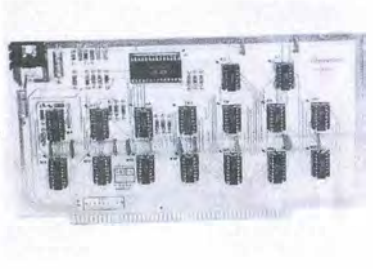
The Model 81 Printer is an 80 cps, 80+ column, bi-directional asynchronous printer, complete with electronics, power supply and cabinet. The printing media is pressure sensitive paper and is friction fed; a ribbon mechanism and a tractor mechanism are offered as options.

The Model 81 Printer with parallel ASCII interface is offered at $615.00. Deliveries are scheduled to begin in December. For further information contact Tele Speed Communications, inc., P.O. Box 647, Syosset, NY 11791.

CIRCLE INQUIRY NO. 142

CL2400 Microcomputer Clock

Cañada Systems CL2400 is a unique S-100 bus real-time clock that keeps the present time of day in hours, minutes, and seconds. Designed specifically for ease of use, the CL2400 is a self-contained hardware clock that continually updates the time, using the highly accurate 60 Hz AC power line frequency as a reference.

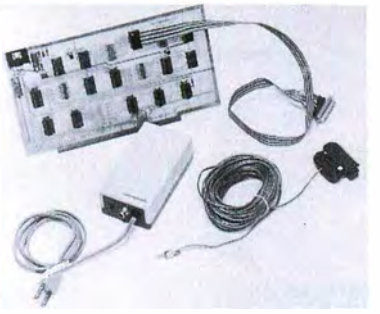


The CL2400 comes with complete documentation, including sample programs in both 8080 assembly language and BASIC. The addition of a single wire between the microcomputer's power supply and the bus is required for the 60 Hz reference. In assembled form the CL2400 is $135. The kits are $98. Delivery is stock to two weeks. For further information contact Cañada Systems, Inc. P.O. Box 516, La Cañada, CA 91011, (213) 790-7957.

CIRCLE INQUIRY NO. 143

Power Control System for the Serious User

Cañada Systems has introduced its PC3200 Power Control System, a series of components that opens up countless new applications for S-100 bus microcomputers.



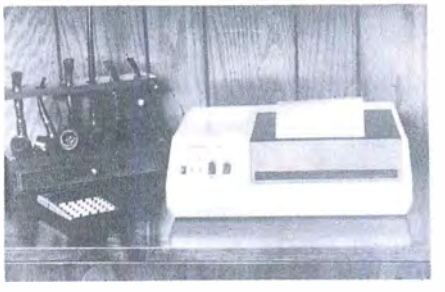
The system components combine to form a high quality AC power switching system that enables microcomputer control of lights, small motors, appliances, tools, etc.

PC3200 System components available are the PC3216 16-channel Control Logic Interface ($189 kit, $240 assm.), and the PC3202 400-watt, 120VAC Power Control Unit ($39.50 kit, $52 assm.) For information contact Cañada Systems, Inc., P.O. Box 516, La Cañada, CA 91011, (213) 790-7957.

CIRCLE INQUIRY NO. 144

$595 Nonimpact Microprinter

The Micro 1 is a nonimpact, high speed, low cost, compact microprinter utilizing electric discharge technology and special aluminum coated paper.



The Centronics microprinter has a print speed of 240 characters per second and sells for $595. It is offered as a complete unit including case, power supply, 96 character ASCII generator and interface, paper roll holder, infrared low paper detector, bell, and multi-line asynchronous input buffer.

For further information contact Centronics Data Computer Corp., Hudson, NH 03051, (603) 883-0111.

CIRCLE INQUIRY NO. 145

The MECA CMS System

The MECA CMS System is a Digital Cassette System which is plug compatible with the Radio Shack Model TRS-80 Computer. The system is designed for business applications such as Mailing Lists, Payroll, Billing and Inventory.

The Meca CMS System can be used in Business Applications by itself or with Floppy Discs.

The Meca CMS System comes assembled and ready for operation. Prices start at $399 for a single drive. Availability is 45 days ARO. For further information contact Meca, 7026 O.W.S. Rd., Yucca Valley, CA 92284.

CIRCLE INQUIRY NO. 146

Intelligent Remote Controller for S-100 Systems

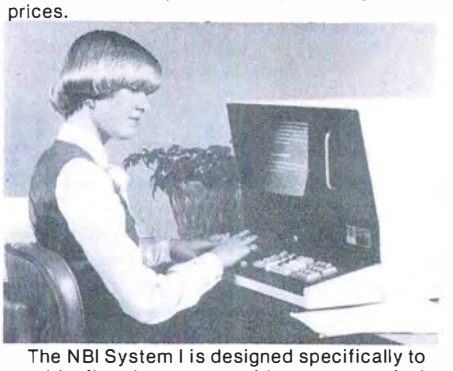
Mountain Hardware's new Introl™ system is a sophisticated remote control system that communicates over the standard 100 VAC power lines. The AC Controller™ board is an S-100 comptaible board that is capable of controlling up to 64 remote units anywhere in your building. The AC Remote™ unit has two independently controllable AC sockets that can turn two 500 watt appliances on or off. The computer can also "poll" the remote to check its status (on or off). Programs can easily be written in BASIC or assembly language or monitor and control remote devices.

Introl system components are available in kit or assembled form. All AC Remotes are housed in an attractive walnut cabinet. Kit price for the AC Controller is $149 and the AC Remote is $99. Contact Mountain Hardware, Inc., P.O. Box 1133, Ben Lomond, CA 95005. (408) 336-2495.

CIRCLE INQUIRY NO. 147

Word Processor Uses Floppy Software for Easy Growth

A software-based word processing system from NBI, Inc. offers users applications flexibility as well as the performance of expensive hardware-based systems at substantially lower prices.



The NBI System I is designed specifically to provide first-time users with an economical and easily upgradeable approach to automating the production of high-volume correspondence — particularly repetitive letters — as well as document editing and production.

Priced at $11,999, the System I allows users to continuously update applications by entering changes on the system's standard diskette, which stores approximately 250K characters, or about 50 pages of text.

For more information contact NBI, Inc., 5595 East Arapahoe Ave., Boulder, CO 80303, (303) 444-5710.

CIRCLE INQUIRY NO. 148

Discs

8080-Based Diskette Drive Intelligent Controller

The Model 1070 Diskette Drive Controller is the first "intelligent" diskette drive controller for microcomputer systems — one able to communicate by file name and assume all "housekeeping" functions usually performed by the CPU.

Designed for interface to most major microcomputers, the Model 1070 incorporates an 8080 microprocessor with internal disc operating software for all file management functions including IBM 3740 formatting and initializing.

The complete PerSci Diskette Drive subsystem includes the Model 1070 Controller, interface, cabling and from one to four Model 70 Diskette Drives or one to two Model 270 Dual Diskette Drives.

The price of the Model 270 Subsystem Is $1,195 and the Model 270 dual capacity subsystem is $1,495, in single unit quantity. Delivery is 30-60 days ARO. For further information contact PerSci, Inc., 12210 Nebraska Ave., W. Los Angeles, CA 90025, (213) 820-3764.

CIRCLE INQUIRY NO. 149

Dual Diskette Drive

The PerSci Model 270 Dual Diskette Drive, incorporating two read/write/erase head assemblies, measures only 8.6" high x 4.4" wide x 15.0" deep. Two units horizontal or four units vertical can be housed in a 19" rack.

This dual drive is fully IBM 3740 compatible and can accommodate a total of 3.8M bits of data per drive (1.9 Mbits on each diskette) in IBM 3740 format.

Also unique to the PerSci drive is the electronic diskette load and unload system which accurately places the diskette, eliminating the possibility of diskette loading damage. This automatic load permits remote control operation of the drive.

For further information, contact PerSci, Inc. 12210 Nebraska Ave., W. Los Angeles, CA 90025, (213) 820-3764.

CIRCLE INQUIRY NO. 150

DATUM 8480 Disc Controller

The DATUM Model 8480 Disc Controller provides a complete, on-line, high-speed, random access, mass storage device for most microcomputers. The controller can accommodate from one to four disc drives of 2.5, 5.0 or 10.0 megabyte size.

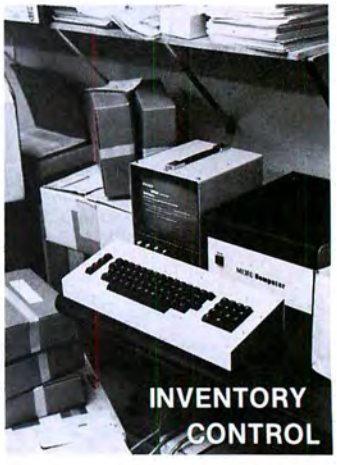
The system features a byte-oriented I/O structure, eight macro commands, a ROM/FPLA-driven sequencer, preprogrammed format functions and a 256-byte sector buffer.

The controller consists of a single printed-circuit board in a 3.5-inch-high chassis with an "intelligent" front panel that gives visual on-line status of the controller. The controller can be purchased without the chassis, if so desired.

For further information contact Datum, Inc.,

INTERFACE AGE MAGAZINE PRESENTS

MICRO BUSINESS '78™ TRADE SHOW



DATE: MARCH 17, 18, 19, 1978

PLACE: PASADENA CONFERENCE CENTER

PASADENA, CALIFORNIA

MICRO BUSINESS '78™ will provide a series of marketing forums and exhibits to introduce the small independent businessman to the new low-cost, high-power business microcomputer that will reduce his company's costs, place him in a more flexible marketplace and provide timely data information.

Emphasis will be on the small budget requirements for purchase of an in-house computer. The show will demonstrate the latest systems, exhibiting complete hardware and software from small hand-held programmable calculators to full turn-key computers.

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- Newly-Released Business Software
- Low-Cost Text Editing Typewriters
- Modularized Computers

THE LOW COST, dependability, simplicity of operation, and cost savings advantages of microcomputers will be discussed in a series of lectures to remove the many misconceptions the adverage businessman may have about the microcomputer technology. Lectures by such companies as IBM, Commodore Business Machines and Radio Shack will present the businessman with the latest information about application, service and investment. Author Adam Osborne will discuss business software.

OTHER LECTURES on the program include:

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- Evaluating Your Business Computer Needs
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- The Small Business Computer Company
- Computer Stores and the Small Business System
- Retail Mass Marketing of Microcomputers

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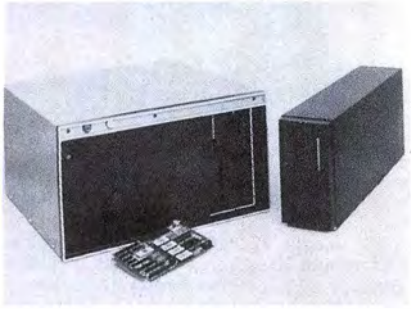
CIRCLE INQUIRY NO. 151

PerSci Diskette-Based Intelligent Mass Storage Systems

A new series of IBM compatible mass storage systems for minicomputer applications has been introduced by PerSci, Inc.



The new PerSci systems, with data capacities to 1 Mbyte formatted, incorporate PerSci's Model 277 Dual Diskette Drives and are available in a variety of configurations, including one or two drive (two or four spindle) system with power supply and cabling enclosed in a 19" rack mountable chassis, with or without microprocessor-based controller, or a "slimline" system, measuring only 4½ inches wide when vertically mounted, which incorporates one dual drive and a power supply in a table top chassis.

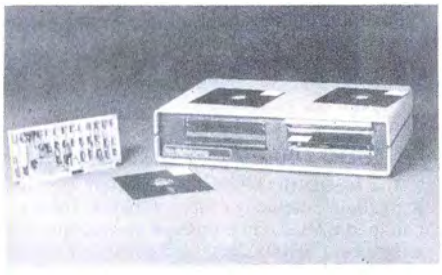
PerSci Mass Storage Systems are available with interface to most major microcomputers. One and two drive systems range in price from $2,110 to $3,995. The controller only is $740. Delivery is 45 days ARO.

For further information, contact PerSci, Inc., 12210 Nebraska Ave., W. Los Angeles, CA 90025, (213) 820-3764.

CIRCLE INQUIRY NO. 152

Floppy Disc Subsystem

A new Floppy Disc Subsystem has been added to The Digital Group product line, making available to the Digital Group user a complete disc storage system with the capabilities of being IBM-compatible.



The disc subsystem includes a Floppy Interface Card, designed for extreme flexibility for the end user. The interface card will accept up to four drives, and they can be either standard or mini drives. The disc subsystem supports standard floppy disc drives (8") from Innovex, Shugart, Pertec and others. These drives may be intermixed.

A kit form of the Disc Subsytem with two Standard Drives is available for $1,395, and $1,545 assembled. For details contact The Digital Group, Inc., P.O. Box 6528, Denver, CO 80206, (303) 777-7133.

CIRCLE INQUIRY NO. 153

Hard Disc for Small Computers

Unmatched in price and capability, the C-D74 from Ohio Scientific provides an unbelievable 35 millisecond average access time to any of 74 million bytes of information. The first drive ever with 12 tracks on a cylinder without reseeking, C-D74 can access any of 220,000 bytes of information in 5 milliseconds.

The 74 megabyte disc also has important applications in both business computing and research in computing itself. The disc makes small computers practical for much larger jobs than formerly thought feasible.

With a 10 millisecond single track seek, the drive has an incredible data transfer rate of 7.3 megabits per second.

The drive, cable, interface for an Ohio Scientific Challenger and OS-74 operating system software is $6,000 F.O.B., Hiram, OH. Equipment rack not included. For further information contact Ohio Scientific, 11681 Hayden, Hiram, OH 44234, (216) 569-7905.

CIRCLE INQUIRY NO. 154

Dual Minifloppy for Less Than $1000!

SWTPC is proud to announce its MF-68 minifloppy disc system. The unit was designed for the SWTPC 6800 computer system with the controller board for the disc drives plugging right onto one of the I/O card slots on the 6800 mainframe. The unit is supplied complete with FDOS software and 8K Disc BASIC. FDOS system commands include CREATE, SAVE, LOAD, RUN, PURGE (delete), PACK, CATALOG, INITIALIZE and PATCH. A minimum of

16K of memory is required on the computer system to operate the MF-68 disc. Each diskette can store approximately 85K bytes of data and the disc system can be expanded to accommodate up to four disc drives.

The MF-58 is sold in kit form only and includes chassis, cover, power supply, controller, cables, software, assembly and operating instructions, plus two Shugart SA-400 drives for $995.00 ppd in the continental U.S. For more information contact Southwest Technical Products Corp., 219 W. Rhapsody, San Antonio, TX 78216, (512) 344-0241.

CIRCLE INQUIRY NO. 155

Z//25 FORTRAN IV Microfloppy

The Realistic Controls Z//25 FORTRAN IV* Microfloppy System features speed, simplicity and reliability; the convenience of a disc operating and file management system; a text editor and general utilities; and the programming power of a resident ANSI FORTRAN IV* compiler.

Up to 75K of formatted programs and data packed into each side of a 5.25" square diskette for a total of 151K per diskette. Positive media interlock, write protect, ceramic head, and a stepper motor - lead screw head positioning system are standard. The S-100 bus compatible floppy interface is a flexible disc driver and parallel I/O module in one. Has two year software update service, complete documentation, and factory support.

For further details, contact Realistic Controls Corporation, 3530 Warrensville Center Rd., Cleveland, OH 44122, (216) 751-3158.

*FORTRAN IV distributed under license from Unified Technologies of Canada.

CIRCLE INQUIRY NO. 156

Upgrade Kit Converts Poly 88 to 8813 Disc-Based System

PolyMorphic Systems, Inc. has introduced an upgrade kit for Poly 88 microcomputer owners who wish to convert their current systems to the company's new System 8813 disc-based microcomputer system.

The Poly 88 Disc Kit contains all mechanical parts and electronic assemblies needed for converting a Poly 88, including chassis, walnut cabinet, a 10-slot backplane, power supply, floppy disc controller, 2K of ROM, a fan, one floppy disc drive and two system diskettes.

The conversion to a disc system takes only a few hours. The Poly 88 Disc Kit is priced at $1,450 and is available from any PolyMorphic Systems dealer. Up to two more disc drives may be added at a cost of $590 each.

The system software for the upgraded computer allows users to run applications either in assembly language or in fully extended BASIC. The use of discs permits interactive computing for the first time in a small system, since storage is more convenient and access times are faster with discs.

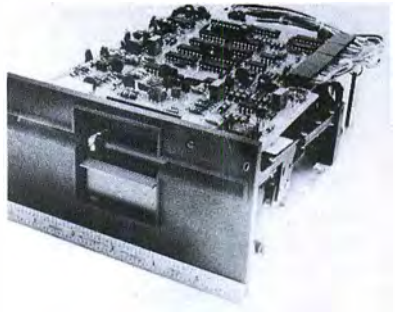
For more information on the disc-based system, contact your nearest PolyMorphic Systems dealer or PolyMorphic Systems, Inc., 460 Ward Dr., Santa Barbara, CA 93111.

CIRCLE INQUIRY NO. 284

5¼" Floppy Systems

Two low-cost 5¼-inch high-capacity floppy-disc systems by Micropolis Corporation offer more than four times the storage capacity of units in this class and built to the reliability standards typically associated with more expensive 8-inch drives.

The first system, designated the MetaFloppy™ 1015, is available in either 35- or 77-track models, single or double density, to a maximum storage of 480 Kbytes unformatted.



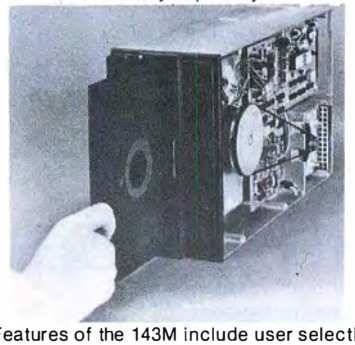
The second system, the 1054 Mod II car store a total of 1,260,000 bytes. It comprises four drives in dual configuration, a controller, power supply, enclosure, all cabling and an improved complete BASIC software package. The 1054 plugs into most 8080-based or Z-80-based microcomputers using an S-100 bus.

The 500 quantity price of the 1015 drive is $299; delivery is 30 days after receipt of order. Single unit price for the 1054 is $3,220 and delivery is 45 days ARO. For more information contact Micropolis Corp., 7959 Deering Ave., Canoga Park, CA 91304. (213) 703-1121.

CIRCLE INQUIRY NO. 157

143M Floppy Disc Drive

The two-sided, double-density multifunction 143M Floppy Disc Drive, with an unformatted capacity of 12.8 megabits, doubles previous capacities offered to OEM's, while offering superior read/recovery capability.



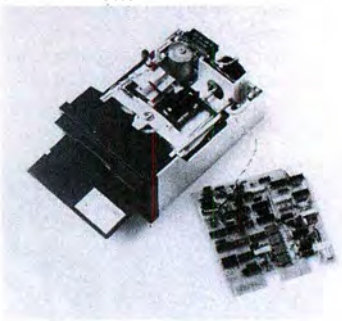
Features of the 143M include user selection of up to four internal drive addresses and one of four independent head load addresses; a 50-pin controller interface affords additional flexibility. the unit's read/recovery capability enables CalComp drives to function without write precompensation in the user's controller.

Single unit price is $750, less applicable discounts. Delivery is 90 days ARO. For further informaton, contact CalComp, 2411 West La Palma Ave., Anaheim, CA 92801, (714) 821-2541.

CIRCLE INQUIRY NO. 158

Micro-Floppy™ Miniaturized Diskette

The Model 82 Micro-Floppy™ diskette drive offers faster access, improved data reliability and increased storage capacity, yet measures only 3.25 x 5.75 x 7.95 inches, and accepts a 5.25 inch diskette.

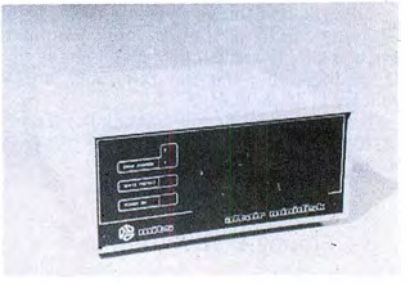


The Model 82 will accept hard sectored diskettes of 10 sectors per track or a modified IBM-type soft sectored format (18 sectors per track, 128 bytes/sector) can be employed. Price for the basic unit is under $300 in large OEM quantities. For further information contact Wangco, Inc., 5404 Jandy Rd., Los Angeles, CA 90066, (213) 390-8081.

CIRCLE INQUIRY NO. 159

Altair™ Minidisk

Pertec Computer Corporation offers an Altair™ Minidisk System with a storage capacity exceeding 71K bytes per diskette and access time of less than 3 seconds.



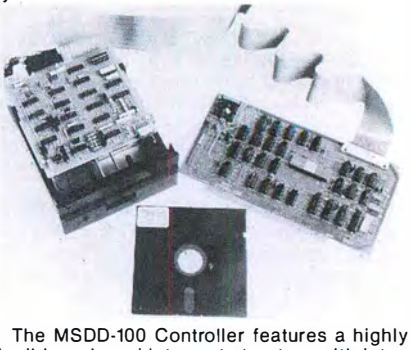
The Altair Minidisk BASIC software resides in the lower 20K of Altair 8080b memory (lower 12K in the Altair 680b) and provides the disc utilization routines.

For more information contact Pertec Computer Corporation, Microsystems Div., 21111 Erwin St., Woodland Hills, CA 91367, (213) 999-2020.

CIRCLE INQUIRY NO. 160

MSDD-100 Floppy Disc System

The MSDD-100 Floppy Disc System features a maximum capacity of 89,600 bytes. The user can load BASIC and programs in seconds. The single card S-100 compatible controller is fully synchronous.



The MSDD-100 Controller features a highly flexible on-board interrupt structure with internal interrupt vector handling. The MSDD-100 Floppy Disc System is provided with complete, preassembled cables, and each unit is shipped with sockets for all ICs. Complete system software is provided.

The MSDD-100 system is available at a cost of $499, for the kit; $599 assembled. For further information contact MSD, Inc., 2765 S. Colorado Blvd., Denver, CO 80222, (303) 758-7411.

CIRCLE INQUIRY NO. 161

Disc Drive Stores Up to 70M Bytes at 1M Bytes/Sec

A new line of fixed-cartridge, moving-head disc drives, from Kennedy Company, stores up to 70M bytes fo data at rates of 1M bytes per second.

Designated the Series 5300, the drives have unformatted capacities ranging from 14M bytes in the single-disc version up to 70M bytes in the three-disc model. Each surface has two 350-tpi cylinders with a recording density of 6000 bits per inch.

Prices range from $2500 to $4000 depending on capacity and quantity ordered. Delivery is 90 days ARO. For more information contact the Kennedy Co., 540 West Woodbury Rd., Altadena, CA 91001, (213) 798-0953.

CIRCLE INQUIRY NO. 162

Floppy System Kit $1,398

Sykes Datatronics, Inc. announces an OEM Floppy System Kit consisting of a smart disc controller (for either IBM compatible or Dual Density formats); up to four Sykes floppy disc drives; interconnecting cable from the controller to disc drives; and a hardware interface for connecting the floppy system to microcomputers.

The microprocessor-based disc controller is packaged for minimum volume on a single PC board which pancakes directly to one disc drive. In this pancake configuration, the controller requires less than one inch of space.

Price for the single drive kit quantity one is $1,398. For more information contact Sykes Datatronics, Inc., 375 Orchard St., Rochester, NY 14606, (716) 458-8000.

CIRCLE INQUIRY NO. 163

Comm-Stor™ RS-232 Floppy Disk System

The RS-232 Compatible Flexible Disk System interfaces directly with all asynchronous terminals, printers and modems.

The unit offers a random access file management system for hard copy or CRT terminals. It is designed around a microprocessor which uses a message (file) oriented directory for flexibility in storing and retrieving data.

OEM quantity prices are in the range of $1500 for a single drive unit and $2100 for a

dual drive unit. For more information contact Sykes Datatronics, Inc., 375 Orchard St., Rochester, NY 14606, (716) 458-8000.

CIRCLE INQUIRY NO. 164

Hard Disc for Small Computers

The C-D74 provides 35 millisecond average access time to any of 74 million bytes of information. With 12 tracks on a cylinder without reseeking, C-D74 can access any of 220,000 bytes of information in 5 milliseconds.

The drive, cable, interface for an Ohio Scientific Challenger and OS-74 operating system software is $6,000 F.O.B., Hiram, OH. Equipment rack not included. For further information contact Ohio Scientific, 11681 Hayden, Hiram, OH 44234. (216) 569-7905.

CIRCLE INQUIRY NO. 165

Terminals

The ACT-II — Affordable Computer Terminal #2

The ACT-II allows dial-up phone communications between a home computerist and a remore time sharing system or another home computer as well as dial-up phone communications between computers.

With a stand-alone ACT-II, remote job entry and execution if economically feasible. The ACT-II (without monitor) slips easily into a briefcase to commute between home and the office. The ACT-II equipped with its optional answer modem makes it possible to communicate with a friend's computer, across town or even across the country and swap software without trading cassettes, paper tapes, or diskettes.

The modem and terminal can operate independently. The modem's TTL in and out lines are available on the rear connectors along with the serial I/O lines of the terminal.

The ACT-II is fully assembled, warranteed for 90 days and costs $550. Contact Micro-Term, Inc., P.O. Box 9387, St. Louis, MO 63117, (314) 645-3856.

CIRCLE INQUIRY NO. 166

Professional Terminal for Hobby Market

Anderson Jacobson, Inc. (AJ), offers a professional quality I/O terminal at a price attractive to the serious hobbyist. The AJ841 is an IBM Selectric terminal and off-line typewriter that includes a built-in ASCII interface and numerous other features attractive to the professional and hobbyist alike.

The unit will be sold by direct mail for an introductory price of $995 plus a small shipping charge. The standard price of the unit is $1195 plus shipping charges. The terminal is fully warranteed for 30 days.

Customers will be able to pick up their terminals at specified AJ service locations where units will be thoroughly tested before delivery. These locations will also provide warranty or repair service as required.

For further details contact Anderson Jacobson, inc., 521 Charcot Ave., San Jose, CA 95131, (408) 263-8530.

CIRCLE INQUIRY NO. 167

Hardcopy Computer Terminal $225 with ASCII Keyboard

Abacus Computer Systems has a low-cost, portable computer terminal that is suitable for microcomputers, computer evaluation kits, data entry systems and time sharing systems. This terminal weighs under 25 pounds with the integral keyboard, hardcopy printer and acoustical coupler.

The terminal is TTY compatible or it can be connected directly to the computer serial I/O port which has standard TTL voltage levels.

The model 800 is $295 with the coupler and $225 without the acoustical coupler. Cost of a ½ inch by 450 feet of roll of paper is 25 cents. Special offer of 200 rolls of paper for $20 when purchased with a model 800 terminal. Send your orders in now as quantity is limited.

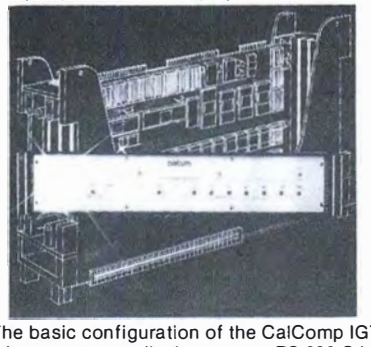
For further information, contact Abacus Computer Systems, 6315 Eunice Ave., Los Angeles, CA 90042, (213) 666-1711.

CIRCLE INQUIRY NO. 168

Interactive Graphics Terminal

The IGT 100 is intelligent, containing microcomputer and display memory to increase local performance and reduce host computer support for the display and manipulation of computer graphics output.

Intelligence allows user controlled functions such as pan, zoom, cursor tracking, grid generation, black on white and white on black display, alphanumeric display and write-thru.



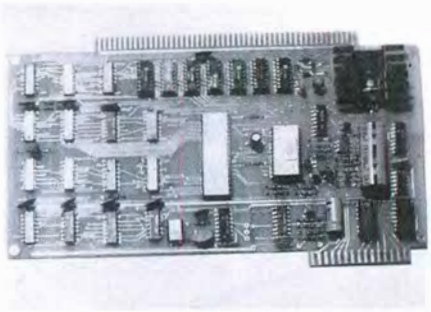
The basic configuration of the CalComp IGT 100 is a processor, display screen, RS-232-C interface and full ASCII keyboard, which includes function and cursor controls. Supporting software is included and optional Plot 10 compatible software is available.

Price of the interactive graphics terminal is approximately $14,700. For more information contact California Computer Products, Inc., 2411 West La Palma Ave., Anaheim, CA 92801, (714) 821-2541.

CIRCLE INQUIRY NO. 169

SCT-100 Xitex Single Card Terminal

A low cost video terminal board designed around the Mostek 3870 microcomputer is now available from Xitex. The board is sized to fit into S-100 systems, but may also be used in stand alone applications.



In S-100 systems the SCT-100 may be powered directly from the unregulated +7 VDC bus (none of the other S-100 bus pins are used). For stand-alone applications an onboard rectifier and filter permit operation of the board directly from an external 12.6 VAC, 1A transformer.

The complete assembled and tested SCT-100 is available directly from Xitex for $185.00. Also available are a partial kit including the P.C. board, the custom programmed 3870 microcomputer, and the preprogrammed character generator ROM for $85 or a complete kit containing all necessary components for $155. For further information contact Xitex, P.O. Box 20887, Dallas, TX 75220, (214) 350-5291.

CIRCLE INQUIRY NO. 170

Selectrics: New and Rebuilt Available

Explore the use of the selectric as a microcomputer terminal for such application areas as word processing, correspondence, newsletter composing, and information retrieval. Complete terminals from $1295 include rebuilt Dura 1021 with selectric mechanism, 14 solenoids for printing and control functions, complete electronics for RS-232 serial ASCII input at 150 baud and all documentation. Terminal is assembled and tested — not a kit.

The electronics interface only is available for $325 in kit form or $395 assembled. Selectric coding on interface is in EPROM and easily altered to use with other 24 volt solenoid selectric mechanisms. For information send stamped, self-addressed envelope to the Center for the Study of the Future, 4110 N.E. Alameda, Portland, OR 97212, (503) 282-5835.

CIRCLE INQUIRY NO. 171

CT-64 Terminal System

The Southwest Technical Products Corporation CT-64 Terminal System kit along with the optional CT-VM video monitor is a complete package providing everything needed for a complete stand alone terminal system compatible with modems and ASCII computer systems of every kind.

MAY THE FORCE BE WITH YOU

See the P.E.T. 2001 Computer from Commodore at

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820 Broadway

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Phone (213) 451-0713

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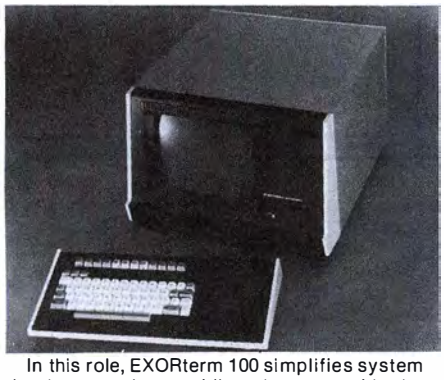
The kit features 16 lines of 32 or 64 characters per line, scrolling or page mode operation, upper and lower case characters, reversed character printing, control character printing, cursor control and complete control character decoding.

The kit includes power supply, keyboard, serial interface, beeper, assembly instructions, chassis and cover and is sold in kit form only for $325.00 ppd. in U.S. The optional CT-VM video monitor is sold assembled, requires the CT-64's power supply and sells for $175.00 ppd. in U.S. For further information contact Southwest Technical Products Corp., 219 Rhapsody, San Antonio, TX 78216, (512) 344-0241.

CIRCLE INQUIRY NO. 172

Display Terminal for EXORciser

The first of a series of display terminals designed specifically for use with the EXORciser Development System is called EXORterm 100. The unit is expressly designed to increase the hardware and software development power of the M68SDT EXORciser.



In this role, EXORterm 100 simplifies system development by providing the user with the means of communicating with his EXORciser. Communications take place via a keyboard and a serial communications link at rates up to 9600 bits per second. A high quality video display using a 12-inch diagonal CRT is provided to present user input and EXORciser response within 24 lines of up to 80 characters each.

EXORterm 100 can be ordered now from authorized Motorola Distributors and Motorola Sales Offices. The unit price of EXORterm 100 is $2200 (US). For further information, please contact the Technical Information Center, Motorola Semiconductor Products, Inc., P.O. Box 20294, Phoenix, AZ 85036.

CIRCLE INQUIRY NO. 173

VDP-400

The VDP-400 cathode ray tube (CRT) device is the first terminal that starts out "intelligent" but still has upward growth capacity.

VDP-400 has several advantages over the other intelligent terminals such as a bigger scroll page, more input/output options, margin set, variable page length, and real time clock.

The video unit can display 1,960 characters arranged in 24 lines of 80 characters each on a 15-inch diagonal display screen.

Input/output interfaces present a variety of user options, with the capability for user programmable protocols. The standard I/O port is an RS-232 asynchronous serial interface.

Separate printer ports allow VDP-400 to interface directly with nearly any type of computer peripheral or connect directly to a computer I/O bus. For further information contact Lear-Siegler, Inc., Electronic Instrument Division, 714 N. Brookhurst St., Anaheim, CA, (714) 774-1010.

CIRCLE INQUIRY NO. 174

Remote Data Entry Terminals for the Link Series of Business Computers

Low cost data entry terminals interface with the company's Link 100, Link 200 or Link 500 small business computers. The lowest priced terminal has a base price of $4,950.00.

Randal Data Systems is the only company

offering a remote terminal with send/receive batch capability and significant data storage for under about $5,000.00.

File capacity is 311,168 characters, organized as 2,431 addressable lines of 128 characters each. Access time averages 0.3 seconds and is 0.6 seconds maximum from keyboard or CPU to any line.

Delivery within 60 days is guaranteed. Further information on the data communications terminals is available by writing Randal Data Systems, Inc., 365 Maple Ave., Torrance, California 90503.

CIRCLE INQUIRY NO. 175

Model MCS-PT Processor Terminal

Designated the Model MCS-PT, this new design is a complete and self contained computer system with display and disc storage, a full keyboard and a 12-slot motherboard. It may be used either as a stand-alone processor or as a processor terminal in a larger system.

tional RAM as an optional item. A disc controller which will handle four drives and a video board are also standard items. The I/O board provides three parallel and three serial ports with selectable baud rates of 75 to 19,200. Outputs are RS-232C or TTL.

Software provided includes CP/M DOS and BASIC on disc. The Processor Terminal fully assembled and tested is priced at $3495.00. The Processor Terminal in kit form is priced at $2995.00. The unit is also available without the disc drive and controller at $2495.00 assembled or $2195.00 in kit form.

For more information contact CMC Marketing Corp., 7231 Fondren Road, Houston, TX 77036, (713) 774-9526.

CIRCLE INQUIRY NO. 176

Data Entry Terminal by Data Pathing

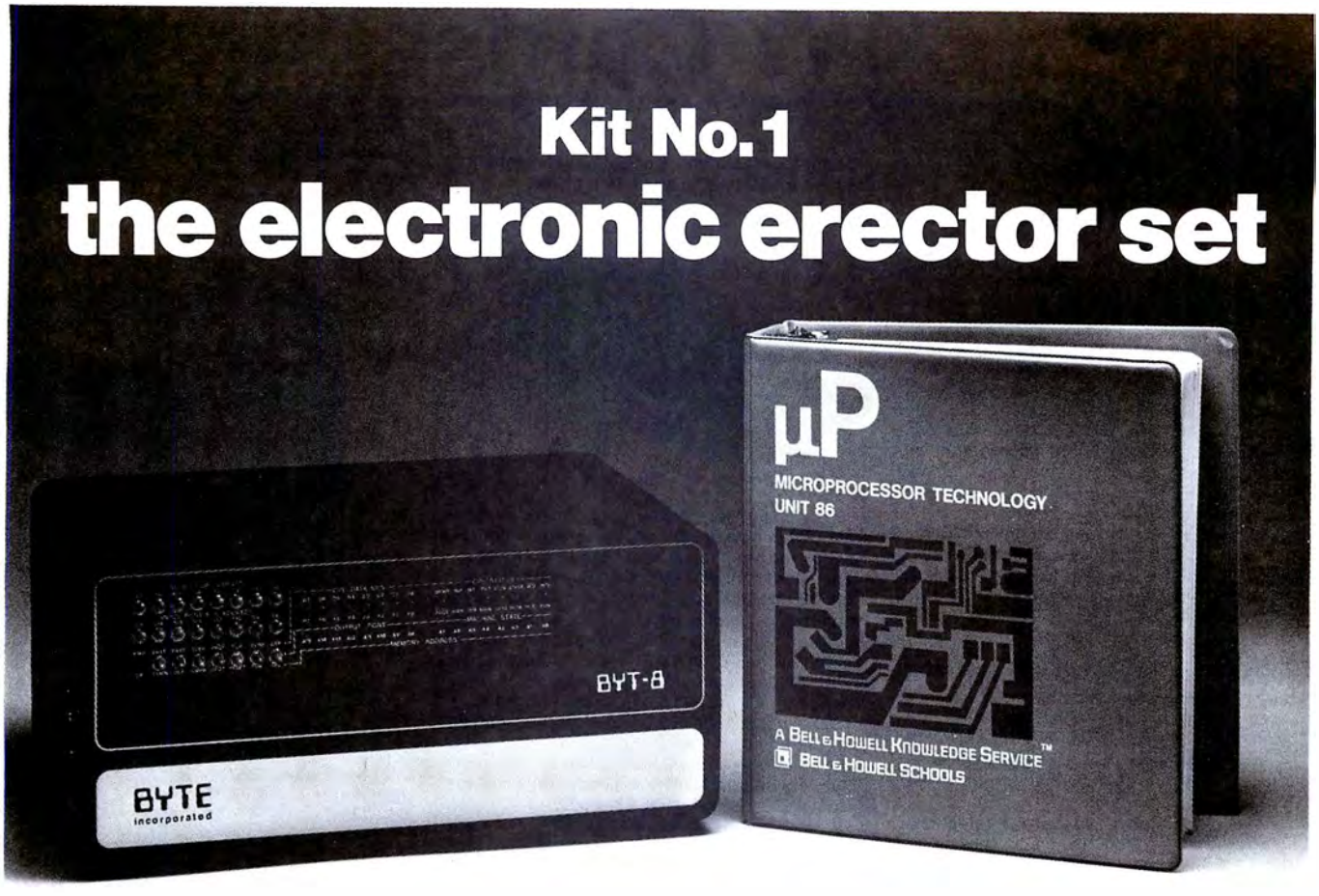
The MIT (Modular Intelligent Terminal) 134 Display Station and the 102 Attendance Terminal are compatible with current Data Pathing equipment, including other terminals, controllers and minicomputers as well as operating and applications software.

The MIT 134 Display Station includes a visual display screen and keyboard. The Display Station features four screen-size formats and either normal or double-size characters. It is designed for use in offices and supplements the MIT 133 which is used primarily in factory environments.

The new unit rents for $58 a month under a five-year agreement; the purchase price is $2,800. The 134 Display Station will be available for customer delivery in the fourth quarter of this year. For further information contact NCR Corporation, Dayton, Ohio 45470, (513) 449-2150.

CIRCLE INQUIRY NO. 177

"Ah ha! Checkmate!"



Our $499 Christmas Special for the gifted businessman, hobbyist or home engineer.

No more nuts and bolts. Today, it's bits and bytes. Or, bytes and bits, as the case may be. That is the bits and pieces of the microcomputer—the electronic erector set. The modern "toy" that stimulates while simulating and intrigues while interfacing.

Business, home or hobby room—there's a computer in your future. With the New Year just around the calendar, Christmas is a good time to start with this handsome gift of equipment; our powerful and popular 8080A microcomputer (pictured above). The funny numbers won't confuse you. The $499 also includes a 426 page instruction course that tells you what it all means. This course was prepared by Bell and Howell Schools and is the industry standard for basic computer instruction. To start all you need is a screwdriver.

To obtain this Christmas Special, or for more facts and figures on the Electronic Erector Set, visit the BYTE SHOP in your neighborhood. Pick up a *free* informational Computer Starter Kit. It tells a lot more about what we mean. Also included are a "get started" flow chart, the computer course syllabus, an official "byte me" button and, if you'll register your birthdate, we'll prepare your very own computer-made biorhythm chart (that's so you'll know the best day to start developing your computer, among other things). But hurry. Christmas isn't next February.

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the affordable computer store

Stores now open in: **Arizona,** Phoenix, Phoenix-west, Tucson; **California,** Berkeley, Burbank, Fairfield, Fresno, Hayward, Lawndale, Long Beach, Marina Del Rey, Mountain View, Newport Beach, Palo Alto, Pasadena, Placentia, Sacramento, San Diego, San Fernando Valley, San Francisco, San Jose, San Mateo, San Rafael, Santa Barbara, Santa Clara, Stockton, Thousand Oaks, Ventura, Walnut Creek, Westminster; **Colorado,** Arapaho County, Boulder, Denver; **Florida,** Cocoa Beach, Ft. Lauderdale, Miami; **Georgia,** Atlanta; **Illinois,** La Grange; **Indiana,** Indianapolis-No.; **Kansas,** Mission; **Montana,** Billings; **Nevada,** Reno; **New York,** Levittown; **North Carolina,** Greensboro, Raleigh; **Ohio,** Columbus, Rocky River; **Oregon,** Beaverton, Portland; **Pennsylvania,** Bryn Mawr; **South Carolina,** Columbia; **Utah,** Salt Lake City; **Washington,** Bellevue; **Canada,** Vancouver, B.C.; Winnipeg, Man. Or write to Byte Incorporated, 1261 Birchwood Dr., Sunnyvale, California 94086. Or phone (408) 734-9000

I/O Cards

PIO4800 6-Port Programmable Controller

The controller is compatible with the S-100 bus and will interface the computer to printers, keyboards, CRT's, or any other parallel device with or without handshaking strobes. It may be operated with or without interrupts, in either the isolated I/O or in the memory-mapped mode.

The PIO4800 contains two channels with three different modes of each channel. Each channel may be programmed for up to three eight-bit ports, which may be operated simultaneously. Whether a port is to be an input, an output, or a bi-directional port is determined by a control word. This control word determines the mode of each port, the direction, strobes, and interrupt capabilities.

Price of the PIO4800 kit is $149.00. Bank-Americard and Master Charge are accepted. Dealer inquiries send attention Dept. D-200. For further information contact I O R, Box 28823, Dallas, TX 75228, (214) 358-2671.

CIRCLE INQUIRY NO. 178

Microprocessor-Telephone Interface

Bidirectional communications between a microprocessor and the telephone system are possible with the new WINCE TOUCH TONE TRANSMIT/RECEIVE MODULE. The module contains a central office quality tone transmitter and receiver.

Applications include automatic telephone dialing/receiving, automatic credit card verification, point of sale terminals, mobile radio telephone systems, PBX diagnostics, etc.

For more information, contact Wintek Corp., 902 N. 9th St., Lafayette, IN 47904, (317) 742-6802.

CIRCLE INQUIRY NO. 283

Two Boards for LSI-11 Type Systems

The Artec board, totally uncommitted and designed for insertion of wire-wrap pins, can accommodate approximately 130 standard 14-pin and 16-pin dual-in-line packages, plus all the necessary passive components.

Featuring ± 12 volts on ground, the board is fully grounded on one side with grounded shield at circuit size.

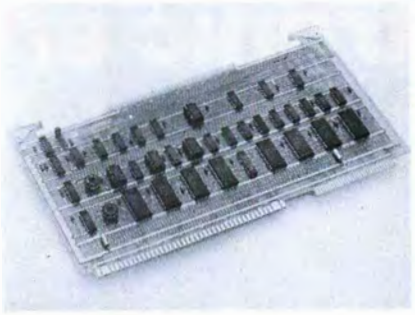
Artec's half-size version (WW-11.5), 5.225-inches wide by 8.4-inches high, sells for $35 in single quantities. The full-size version (WW-11), 10.450-inches wide by 8.4-inches high, is priced at 175 in single units. Both boards are available for immediate delivery.

For more information, contact Artec, 605 Old County Road, San Carlos, CA 94070, (415) 592-2740 or Paul Plansky at Tycer-Fultz, Palo Alto, (415) 328-6300.

CIRCLE INQUIRY NO. 179

High Speed I/O Expansion Card

The BLC 508 Input/Output Expansion card is the newest addition to National Semiconductor's Series/80 Board Level Computer series based on the 8080 microprocessor. The simple, cost effective board provides 8-bit parallel ports, four input and four output, and sells for $315 for 1-9, $189 in quantities of 100.



The board can transfer data at rates at high as 1.3 megabytes per port; the practical limit is set by the peripherals or I/O handling software. The board connects to the system bus through the 86 pin card edge, and has a 100 pin edge connector for parallel I/O. Data, address and control signals are TTL compatible, and it oeprates on +5VDC. The four output ports have a variable width strobe available for peripherals, which is set in a range from 100 to 1600 nanoseconds by a convenient plug jumper on the board.

For more information contact National Semiconductor, 2900 Semiconductor Dr., Santa Clara, CA 95051, (408) 737-5000.

CIRCLE INQUIRY NO. 180

20% Discount on Parallel & Serial I/O Interfaces for Cassette Transport

Due to significant increased production volume of its I/O Interface Options MFE Computer Access Systems is able to pass on these volume savings to customers of the Model 250B Digital Cassette Transport.

The average price of Option 214Par (Parallel I/O for 8 bit computers) has been dropped 20%, while the average price of Option 204SER (Serial I/O for data communications) has been dropped 10%.

These interface boards physically plug into and become part of the MFE 250B Digital Cassette Transport and provide the user with all the hardware necessary to operate the transport and record data on a cassette in ANSI/ECMA compatible format. The I/O connector is a 40 pin, 3M type 3432.

The new single quantity price for Option 214PAR is $260.00, while Option 204SER is $135.00. Delivery is three weeks ARO. For further information contact MFE, Keewaydin Dr., Salem, NH 03079, (603) 893-1887.

CIRCLE INQUIRY NO. 181

Isolated Digital Output Boards for Motorola Microcomputers

Users of Motorola Micromodule and EXORciser® microcomputer systems can now obtain a plug-compatible 16 or 32 channel isolated digital output system that is memory mapped.

Burr-Brown's MP701 (16-channel) and MP702 (32 channel) systems provide all necessary control and timing circuitry and include contact-closure outputs rated at 28V and 0.5A (Resistive load).

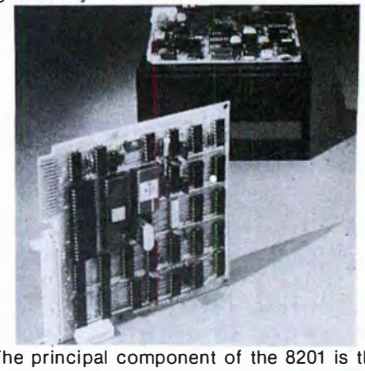
The units, which are mechanically and electrically compatible with the Motorola systems, operate from the microcomputer's +5VDC supply.

Prices for the 16-channel MP701 are $295 (1-9), $265 (10-24) and $225 (25-99). For the 32-channel MP702, $475, $425 and $360 respectively. Delivery is from stock. For more information, contact Burr-Brown, International Airport Industrial Park, Tucson, AZ 85734. (602) 294-1431.

CIRCLE INQUIRY NO. 182

LSI-Based Controller for Micro-Diskette Drives

The new Wangco 8201 Micro-Controller™ 5¼-inch diskette drives provide a general purpose host interface for use in 6800 and 8080 based microcomputer systems, minicomputers and other byte oriented systems. One version of the 8201 is pin compatible with the industry standard S-100 bus. A single printed wire board plugs directly into the S-100 connector.



The principal component of the 8201 is the new Intel MCS 8048, a state-of-the-art microprocessor providing 1K of ROM RAM and I/O ports on a single chip. The intelligence of the microprocessor facilitates a nine macro-command structure in the system which greatly reduces host overhead requirements.

The Wangco 8201 will control up to four drives. Price is $490 in single unit quantity. Delivery 30 days ARO. For further information contact Wangco, Inc., 5404 Jandy Place, Los Angeles, CA 90068, (213) 390-8081.

CIRCLE INQUIRY NO. 183

SBC and S-100 Adapter

Celetron Data has announced an adapter board permitting the use of Intel SBC 80/10 or SBC 80/20 single board computer with nearly all S-100 based memory boards, interface boards and other accessories. The availability of this interface adapter in the form of a

backplane makes it possible to use a microprocessor system which is in heavy commercial use in industry with nearly all the boards which have been designed for the pseudo standard personal computing S-100 bus.

SBC boards are plugged in at one and and S-100 boards are plugged in at the other. S-100 boards will require an external power providing +8 VDC and also ± 15 VDC if required by the particular S-100 boards which are being utilized. All logic conversion is done on the interface board. Pricing is dependent on the number of connectors ordered with the adapter interface. Delivery is stock to 30 days.

For further information contact Celetron Data, P.O. Box 6215, Syracuse, NY 13217, (315) 422-6666.

CIRCLE INQUIRY NO. 184

Programmable Character Generator

This new S-100 card adds the ability to dynamically create the characters generated by a video display device. For those who require special mathematical or scientific symbols, APL characters, sub- and super-scripts, high density bar graphs, Greek letters, or game characters such as space ships, the programmable character generator allows the creation and storage of the new characters while retaining intact the original character set. The original character set remains available for use at any time.

Keyboard interface and dual joystick interfaces are provided on the board. The programmable character generator is an ideal addition to Sol™ terminals, the PolyMorphic™ VTI, the Processor Technology™ VDM-1, the Solid State Music™ video board, and other video display devices utilizing the Motorola™ 9x7 matric character generator.

For additional details, inquiry direct to Objective Design, Inc., P.O. Box 20325, Tallahassee, FL 32304.

CIRCLE INQUIRY NO. 185

M712 General Purpose Bidirectional I/O Board

The M712 requires only the cassette drive and control logic, both user supplied, for operation with an Imsai, Sol or other S-100 computer.

The price for the M712 is $99.95 in kit form and $119.95 assembled. Delivery is off the shelf to 30 days ARO. All orders should include $2.50 to cover shipping and handling and COD orders should include an additional $2.50 to cover the COD costs. Master Charge orders are accepted with a 5% service charge added to the total bill. Indiana residents should include 4% sales tax.

Additional information may be obtained by contacting Micrologic's national distributor, The Byte Shops of Indianapolis at (317) 842-2983 or by writing to 5947 E. 82nd St., Indianapolis, IN 46250.

CIRCLE INQUIRY NO. 186

Magnetic Tape Controller (MTC)

A single S-100 card will serve as an interface and formatter for most of the digital tape drivers now available. This includes the tape cartridge (for DC300A), mini-cartridge (for DC100A), Phillips cassette, and new mini-cassette drives. Data encoding and decoding is by the standard phase (Manchester II) scheme. Hardware generation and check of the 16 bit CRC character are provided on the board.

Versions of the magnetic tape controller (all compatible) are available with TTL and TTL open collector drivers, both with and without terminating resistors on the input lines. Sufficient I/O lines are provided to control all of the standard drive motion functions and to implement daisy-chained multiple drives. Timing is crystal controlled (no monostables) — with gap and dropped bit detect circuits also tied to the crystal oscillator. A DIP switch sets the timer over a range that includes the 48,000 bits per second of the cartridge and extends down to mini-cassette data rates.

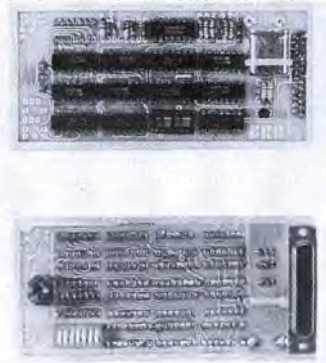
The magnetic tape controller is based on the NEC μP371 LSI cassette/cartridge controller. The MTC will function in interrupt or status bit modes and does not use DMA. The MTC is available as a separate card and with fully packaged mass storage systems. Intel™ MDS™ and stand alone (with internal CPU) versions are anticipated. Software support (8080 and Z-80) ranges from low level drivers to full tape operating systems.

For further details and pricing information contact Objective Design, Inc., P.O. Box 20325, Tallahassee, FL 32304.

CIRCLE INQUIRY NO. 187

Cassette Interface Operates at 2400 Baud

Microprocessor programs and data can be loaded and dumped from an audio cassette eight times faster than the standard 300 baud with the new Wince Cassette Interface.



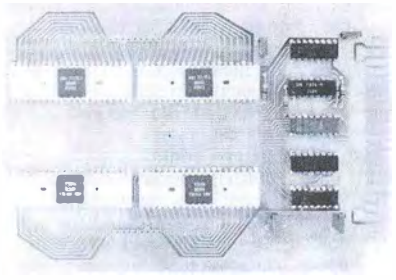
The interface also supports 300 baud Kansas City Standard operation. It interfaces directly to the Motorola 6850 ACIA. The 2½" x 5" module also contains an RS-232 interface for standard baud rates from 150 to 9600. Quantity one price is $139. Other Wince Micro Modules are on industry standard 4½" x 6½" 44 pin printed circuit boards and include the control, RAM, ROM, EROM programmer, CMOS RAM/battery, analog interface, FD interface, touch tone trans/rec, and driver/sensor. Wintek Corp., 902 N. 9th St., Lafayette, IN 47904, (317) 742-6802.

CIRCLE INQUIRY NO. 188

80 Line Digital I/O Board

This board has eight 8-bit bidirectional I/O ports and 16 interrupt lines. Each I/O line is independently software programmable as an input or output. Eight of the 16 interrupt lines are also programmable as outputs or inputs.

The 80 I/O lines are brought out to two 50 pin connectors; 40 I/O lines to each and 10 ground each. Flat cable may be soldered directly to these connectors or you may use the scotchflex type connector, Molex type pins or insertion wirewrap pins. There are large areas of ground and voltage plane and numerous bypass capacitors to suppress noise. The edge connector is the standard 44 pin connector used with the Atwood bus.

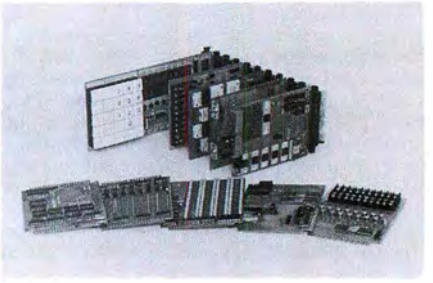


Board sells for $59.95 in kit form. An 8-slot Mother Board is also available with a ¼ rack card guide for an additional $40.00. See our ad or contact Atwood Enterprises, P.O. Box 5203, Orange, CA 92667.

CIRCLE INQUIRY NO. 189

Micro Interface Modules

WINTEK has added an Analog Interface Module and a Driver/Sensor Module to their line of WINCE Micro Modules. The Wince Analog Interface Module allows the input of analog signals from thermocouples, pressure transducers, etc. and the output of analog signals to motors, servos, etc.



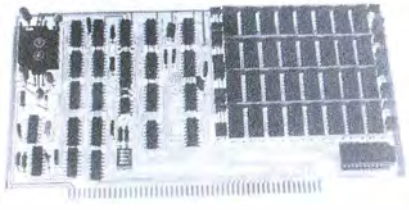
Options include one 16-channel multiplexer, an 8, 10, or 12 bit analog-to-digital converter, and one or two 8-bit digital-to-analog converters. The price is $99.00 plus options. The Wince Driver/Sensor Module is for driving or sensing heavy loads such as relays, motors, etc. Options include up to 16 drivers or 8 sensors. The price is $69 plus $3 per driver. All Wince Micro Modules are on 44 pin 4½" x 6½" boards. Wintek Corporation, 902 N. 9th St., Lafayette, IN 47904, (317) 742-6802.

CIRCLE INQUIRY NO. 190

Memory Cards

Altair™ Memory Module 88-16MCD

The 88-16MCD memory module provides 16K bytes of dynamic RAM and is competitively priced at $395 (suggested retail price).



By implementing low power and fast access dynamic memory integrated circuits, the Altair 88-16MCD runs at a maximum power dissipation of three watts and a maximum time of 350 nanoseconds.

Crystal-controlled logic timing eliminates the need for on-board one-shot multivibrator circuitry. This results in continuous operation without wait states for greater reliability. The board incorporates hidden refresh of the RAM chips.

For further information contact Pertec Computer Corporation, 21111 Erwin St., Woodland Hills, CA 91367, (213) 999-2020.

CIRCLE INQUIRY NO. 191

2708 and 2718 E-PROM Programmer

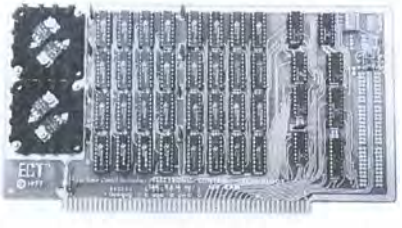
Requires only 1½ I/O ports, for all 5 volt microcomputers. Packaged on PC board. Furnished with software for Motorola 6800 D1, D2 Kits or Fairchild F-8 Kit #1. The software has a verify mode to confirm that all memory locations have been programmed correctly.

Assembled and tested with software, $59.95. Without software but with software instructions, Kit $33.00. For further information contact Optimal Technology, Dept. 2, Blue Wood 127, Earlysville, VA 22936.

CIRCLE INQUIRY NO. 192

16K RAM Fully Static Memory

Electronic Control Technology's 16K RAM memory board is a fully static 16K S-100 bus memory board which utilizes a 4K fully static memory IC (TMS-4044) like the 21L02 except that it has four times the capacity per IC package and less power per bit.



Being fully static eliminates the incompatability with DMA devices or other devices which sometimes occurs with dynamic or clocked static memory. All signals to MOS devices are buffered by low power TTL to prevent damage by static electgricity and to minimize capacitive loading on the bus. Low profile IC sockets are provided for all IC's. The board has solder mask and a silk-screened legend. 2MHz operation is standard and 4MHz is optional at a slightly higher price. The introductory kit price is $450.

For more information contact Electronic Control Technology, P.O. Box 6, Union, NJ 07083, (201) 686-8080.

CIRCLE INQUIRY NO. 193

16K Memory Board for Heath H8

Two memory boards for the new Heath H8 minicomputer system are of the static variety and physically match the physical and electrical bus requirements of the Heath H8 system. One version utilizes the same Texas Instruments 4K statis IC's as chosen by Heath for their system; this board is designated as the Hk-16K. The other version uses a unique 4K static RAM with extreme low power consumption and would permit the user to have 64K of RAM in his Heath H8 system without taxing the capabilities of the Heath power supply. Both boards will be available in either kit or assembled and tested form.

The boards will be available partially populated in 4 or 8K versions, or fully populated. The PC boards are of commercial grade, epoxy glass with plated-thru holes and are furnished with all IC sockets.

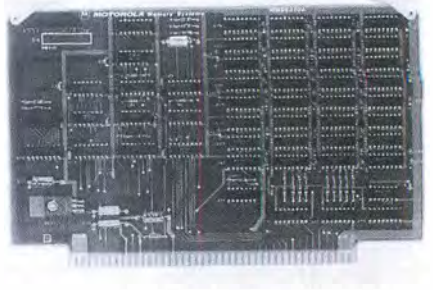
Additional information can be obtained by writing or calling Celetron Data, P.O. Box 6215, Syracuse, NY 13217, (315) 422-6666.

CIRCLE INQUIRY NO. 194

Memory System for M6800 Kit

A memory system for expanding the memory capacity of Motorola's MEK6800D2 Kit is now available from Motorola's Integrated Circuit Division.

The MMS68104 is a 16K word x 8 bit system that is pinout compatible with the "D2" Kit. The 68104 memory card is designed expressly for the Kit and home hobbyist markets.



In quantities of one to 5 the MMS68104 is priced at $395.00, in lots of 6-24, $375 and in lots of 25-99, $360.00. Delivery is four weeks ARO from the factory. For further information contact Memory Systems, Motorola Integrated Circuits Division, 3501 Ed Bluestein Blvd., Austin, TX 78721.

CIRCLE INQUIRY NO. 195

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North Star Horizon Single Drive System includes the Z-80 CPU at 2 or 4 MHz, motherboard, 16K of memory at 4 MHz and power supply. Software includes Disk Operating System and Disk BASIC. Horizon 1 kit is $1599. Dual Drive Horizon is also available at $1999.

We add monitor and keyboard.

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Your cost for separate kits would total $2238.00.

Your assembled price from Sunshine Computer Company is $2296.00.

OPTIONS

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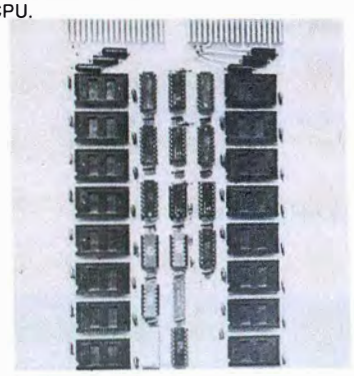
RMRV-8K, 8K x 16 EPROM Board for LSI-11

The RDA, Inc. RMRV-8K is an 8K word by 16 bit EPROM memory board which occupies one dual height module slot in the LSI-11 backplane. Packaging density is achieved by using the easily programmed and UV erasable 2708, 8192 bit (1K by 8 bit) memory IC. Addressing is jumper selectable for any two 4K banks in the 0-28K address space. Bus handshake logic is handled in 1K segments, i.e., anywhere from 1 to all 8K of the available segments may be enabled to reply to a memory read request from the CPU.



The RMRV-8K EPROM memory board consists of bus interface elements IC1 to IC5, address latch and decode elements IC6 to IC10, and handshake control elements IC11 to IC14, in addition to memory elements IC16 to IC31.

For further information contact RDA, Inc., 5012 Herzel Place, Beltsville,MD 20705, (301) 937-2215.

CIRCLE INQUIRY NO. 196

8K Memory/Video Generator

For about what you would expect to pay for an 8K memory board you can have a dense dot raster graphic display function also! The MTU K-1008 Visible Memory is an 8K memory add-on to the KIM-1 system including circuitry to simultaneously display the memory contents as 64,000 dots (320 wide x 200 high) on a TV monitor. The board is designed to connect to an unmodified KIM-1 directly in parallel with the expansion connector. The KIM-1 continues to run at full speed with no wait states or visible interference on the screen when the display memory is being accessed.

Power requirements are +7.5 volts at 250 MA and + 16 volts at 250 MA both unregulated. A software package containing sophisticated character display and graphing routines is available.

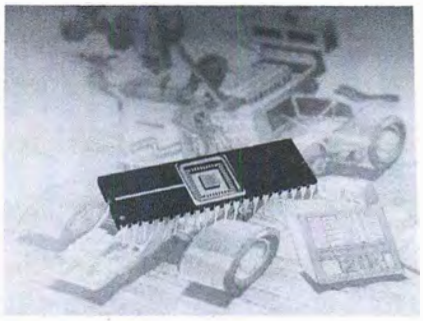
K-1008 Visible Memory board assembled and tested, $289.00. Bare board only, $40.00. Graphics software package (source listing), $20.00 (avail. to board purchasers only). For more information contact Micro Technology Unlimited, Box 4596, Manchester, NH 03108.

CIRCLE INQUIRY NO. 197

Combination RAM-I/O Chip for Microprocessors

A new N-channel large-scale IC device from National Semiconductor combining memory storage and peripheral interface capability, can do the job of five or more standard memory and I/O parts.

Known as INS8154, the combined RAM and I/O chip is ideally suited for low-end microprocessor-based systems that may require a relatively small memory capacity but still need a number of peripheral interfaces.



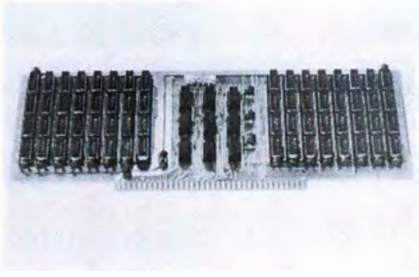
The 40-pin circuit, which directly interfaces with SC/MP II, INS8080A and other National microprocessors, contains 128 eight-bit words of static RAM, together with two 8-bit parallel I/O ports that are bit-programmable to provide maximum flexibility. Each I/O pin may be defined either as an input or output.

Price for 100 quantities is $8.75. For further information contact National Semiconductor, 2900 Semiconductor Dr., Santa Clara, CA 95051.

CIRCLE INQUIRY NO. 198

32K Static Memory Card

The Digital Group, Inc. has designed a fully-static memory card containing 32K of memory. With this card, a full 64K system now requires only two boards instead of eight, leaving one extra memory slot on a Digital Group standard motherboard for future products.



The memory card may be intermixed on Digital Group systems with the company's current 8K memory cards. All data and address lines are buffered. The card itself incorporates the TI-TMS 4044 or equivalent.

The complete 32K memory board with all ICs, connector, sockets, discretes, and PC board is available in kit form for $845. Assembled version is $945. For details contact The Digital Group, Inc., P.O. Box 6528, Denver, CO 80206, (303) 777-7133.

CIRCLE INQUIRY NO. 199

Semikits

A 16KRA memory board for $369 in semikit form has been introduced by Processor Technology Corp.

The semikit's memory modules will bring an end to such common kit-building problems as bad solder joints, heat damaged components and faulty integrated circuits. Full documentation is provided with step by step procedures for the user to test and burn-in the boards.

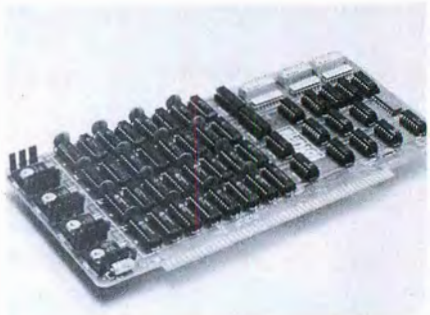
Features of the first semikit include a 16,384 byte memory, invisible refresh and worst case access time of 400 nsec. Each 4096 word block is independently addressable for maximum system flexibility. Power is typically 5 watts, the same as most single 4K memory modules. Backup power connection is built-in.

The 16KRA board is also available fully assembled, tested and burned-in for $399.00. For more information, contact Processor Technology Corp., 6200 Hollis St., Emerysville, CA 98608, (415) 652-8080.

CIRCLE INQUIRY NO. 200

16K RAM

The 16K Space Byte is a fully static, state-of-the-art RAM, utilizing the TMS-4044 (4K by 1 bit static). The Space Byte is addressable in 4K blocks at 4K boarders with DIP switches; in addition, memory write protect and disable are also controllable by DIP switch in 4K blocks. (write protect and disable [Phantom] also controllable with software by simple jumper connection). Battery back-up capability with either direct connector, or jumper connection through bus.



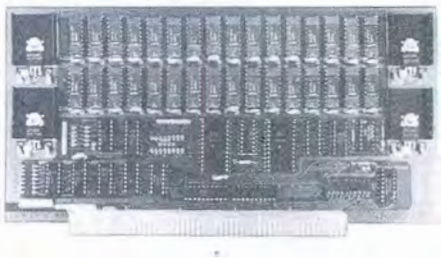
The 16K Space Byte is fully S-100 compatible with Altair, Vector One, Imsai, Poly 88, Sol-20, Compal 80, AM-100 (DMA disc).

The 16K Space Byte is offered fully assembled, burned in and tested with a solder mask and silk screened G-10 P.C. board. $599. Available through computer dealers everywhere or contact The Space Byte Corporation, 1720 Pontius Ave., Suite 201, Los Angeles, CA 90025, (213) 468-8080.

CIRCLE INQUIRY NO. 201

16K Static RAM with Paging

Digital Micro Systems offers a 16K static RAM for the S-100 bus that uses the industry standard 2114 memory chip and had many extras. The board is completely static, having none of the timing incompatibility problems associated with dynamic or clocked chip select "static" RAMs. This means that the DMS board will run with any S-100 system including DMA systems and the 16-bit Alpha Microsystems AM-100. It also runs on Z-80 systems at the full 4Mhz clock rate.



The board features individually addressable 4K blocks, software write protection in 4K blocks, and a powerful paging or block select feature.

Normal price is $525 for the 16K kit, $295 for

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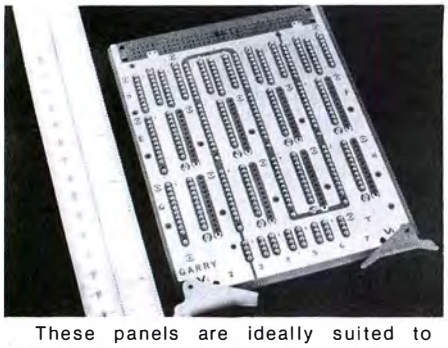
the 8K kit, and $595 for the assembled and tested version, but there is an introductory 16% discount until December 31, 1977. Available from stock.

For more information or to order contact Digital Micro Systems, Box 1212, Orem, UT 84057, (800) 453-1444 or (801) 224-2102.

CIRCLE INQUIRY NO. 202

Dual-Voltage Packaging Panels

Garry Manufacturing Co. announces dual voltage I.C. Pluggable Memory Board PS108 322-14-3C, consisting of eight 22-pin (4KRAM or ROM) I.C. patterns, four 8-pin I.C. patterns and eight 16-pin I.C. patterns. These panels provide a dual planar voltage system, V_1 and V_2, along with a common ground distribution plane.

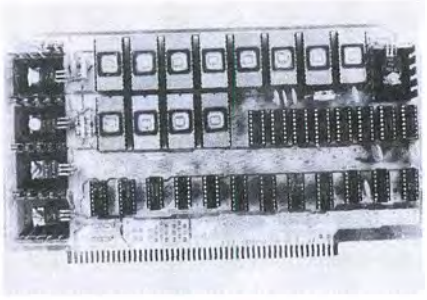


These panels are ideally suited to microprocessor, minicomputer memory packaging using RAM or ROM as well as MSI/LSI and other digital devices. They are available on two to four week delivery at prices from $1.00 to $2.50 per I.C. position. For complete information use the Reader Service Card, or contact Garry Manufacturing Co., 1010 Jersey Ave., New Brunswick, NJ 08902, (201) 545-2424.

CIRCLE INQUIRY NO. 203

Vector PROM/RAM Up To 12K

Vector Graphic Inc. is introducing a new PROM/RAM board with iK on-board RAM and capacity for up to 12K 2708 type EPROMs. The board occupies two independently addressable 8K blocks. Complete addressing flexibility is provided to conform to virtually any system configuration with a minimum of address jumpers required.



Video boards or disc operating systems can be nested in the 3K of unused space. MWRITE logic and jump-on-reset allow operation without a front panel. A 24 command PROM monitor is available to interface with most popular I/O boards. Available October 1, 1977. $135 kit, $175 assembled.

For further information, contact your local dealer or Vector Graphic Inc., 790 Hampshire Road A-B, Westlake Village, CA 91361.

CIRCLE INQUIRY NO. 204

Memory Boards

8K EPROM uses UV EPROMs (not included). Dip switch addressable to any 8K memory boundary. Can be addressed to E000 to replace MIKBUG® using your own system monitor. Instructions included for minor CPU board modification when used for this.

16K Static RAM uses TMS4044 4K by 1 Bit fully static RAMs. 4 independent 7805 voltage regulators. Typical worst case power dissipation is 2 amps. Each 4K block is dip switch addressable at any 4K boundary. Memory write protect and memory disable (Phantom) are controllable in 4K blocks by dip switch.

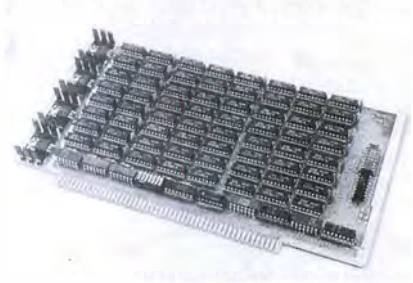
Also available: Mother Board, 13 full size SS 50 bus. Fits SWTP mainframe. Ideal expansion board, or for those users who need or will be needing a larger system. Serial ACIA.4 port RS 232 or 20M A current loops. Individual dip switch selectable baud rates. Dip switch selectable addressing.

For further information, contact Gimix, Inc., 1337 W. 37th Pl., Chicago, IL 60609, (312) 927-5510.

CIRCLE INQUIRY NO. 205

MEM-1

The MEM-1 is an eight kilobyte static RAM memory board. Kits have NEC 2102AL-4 500ns low power memory chips. All input and output data lines are fully buffered. All possible support chips are low power Schottky.



The board can be set in 8Kb increments. Delays can be selected on the board so that any speed 2102 memory chip can be used.

Prices are $30 bare (without parts); $250 kit; $295 tested and assembled. For further information contact WMC, Inc., 3107 Laneview Dr., San Jose, CA 95132.

CIRCLE INQUIRY NO. 206

Test Equipment

RCA COSMAC Micromonitor

The COSMAC Micromonitor, CDP18S030, permitting in-circuit debugging of any CDP1802 microprocessor system hardware and software in real time, is now available from RCA Solid State Division.

Completely self-contained in an attache case, the Micromonitor is a useful field-service tool, a flexible production tester, and a valuable prototyping adjunct. It includes a built-in keyboard, display, and status indicator lights, as well as software debugging routines. A special feature is a self-test card which simulates a user system to allow verification and assurance of Micromonitor operation.

Operation, installation, and application information is provided in the *Instruction Manual for the RCA COSMAC Micromonitor CDP18S030*, MPM-218, and is included with the instrument.

In single quantities, the RCA COSMAC Micromonitor CDP18S030 is priced at $1600 (domestic). For further information and copies of the Product Description, PD18, contact RCA Solid State Division, Box 3200, Somerville, New Jersey 08876.

CIRCLE INQUIRY NO. 207

Intel μScope™ 820 Microprocessor System Console

The μScope 820 provides a means of maintaining and troubleshooting microprocessor based end products. The μScope 820 console has been specifically designed to ease the task of microcomputer system check-out for manufacturing, field support, and field service of microprocessor equipment.

A portable unit that is easily carried to the system that requires testing, the μScope 820 comes fully packaged in a standard size briefcase which provides storage for all required accessories. It is an easy-to-use instrument that provides sophisticated troubleshooting capabilities. Even difficult problems can be found by relatively inexperienced production/field personnel.

For further information, contact Cramer Electronics, 85 Wells Ave., Newton, MA 02159, (617) 969-7700.

CIRCLE INQUIRY NO. 208

Model FSS-250DC Automated Interference Analyzer with Simultaneous Plotting of CISPR/VDE and MIL STD/SAE

Designated as Model FSS-250DC, the new system features simultaneous X-Y plotting of both CISPR/VDE quasi-peak and MIL-STD/SAE-type peak measurements over the frequency range from 10 KHz to 1,000 MHz.

Included in the new system is the CMM-25 Metering Module which operates with the EMC-25 Interference Analyzer to provide automatically all of the unique CISPR/VDE-mandated bandwidth and detector characteristics. Also incorporated in the system is a panel-mounted version of Electro-Metrics' popular CIG-25 Impulse Generator, which provides calibrated broadband outputs at variable

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repetition rates, used in generating calibrated X-Y plots.

System operation is normally controlled from the ESC-125 Electro-Scan Programmer. However, if the optional "B" version of the Programmer is selected, the user can generate spectrum-analyzer-type displays, with RF preselection on either a conventional or storage scope, in addition to, or in lieu of, those available on the SPD-125 Spectrum Display Module.

The FSS-250DC is priced at approximately $55,000, depending on options and accessories chosen. For further details, contact Penril Corp., Electro-Metrics Division, 100 Church St., Amsterdam, NY 12010, (518) 843-2600.

CIRCLE INQUIRY NO. 209

80MHZ Universal Frequency Counter

The 80MHz Universal Frequency Counter, Model 1820, features guaranteed frequency measurement to 80MHz; 100MHz is typical. Period measurement capability offers accurate high-resolution measurements from 5Hz to 1MHz. "Accumulate" and "elapsed-time" functions are also featured.

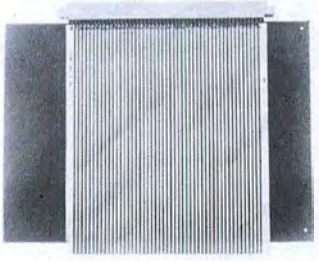
The 1820 is fully autoranging, with automatic decimal point position and MHz/kHz readout. The 1820 features a six-digit .43" high LED display, with leading zero blanking. Available options include a TCXO (temperature compensated crystal oscillator) time base, 10:1/direct probe and leatherette carrying case.

The B&K-Precision Model 1820 is priced at only $260 and is available for immediate delivery at local electronic distributors. For additional information, write: B&K-PRECISION, 6460 W. Cortland Ave., Chicago, IL 60635, (312) 889-9087.

CIRCLE INQUIRY NO. 210

Card Extenders Aid Microcomputer System Design and Debugging

A circuit card extender, from Vector Electronic, is form and plug compatible with Altair 8800, IMSAI 8080, and other similar microcomputer CPU, memory, and interface boards. Designated the 3690-12, the extender facilitates out-of-chassis troubleshooting and hardware debugging.



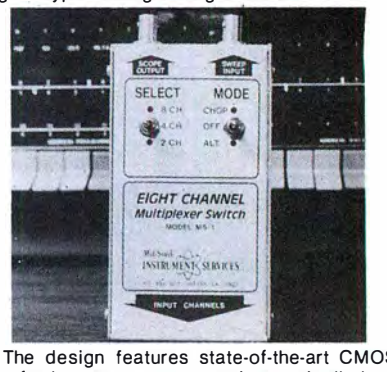
The 7.5-inch high by 9.99-inch wide extenders are fabricated of high quality 0.0625-inch thick epoxy-glass composite material. The two-ounce copper conductors are solder tinned while the card edge connectors are gold-flashed nickel plate for low contact resistance and reduced wear.

The Vector 3690-12 is fully assembled and in single unit quantities is priced at $25.00. For more information contact Vector Electronic Co., Inc., 12460 Gladstone Ave., Sylmar, CA 91342, (213) 365-9661.

CIRCLE INQUIRY NO. 211

MS-1

The MS-1 Multiplexer Switch is an inexpensive, compact adaptor for converting any conventional, single channel oscilloscope into a multichannel logic analyzer for troubleshooting all types of digital logic circuits.



The design features state-of-the-art CMOS ICs for low power consumption, typically less than 6 mA total. This results in a unit that is ideal for field service applications where AC power may not be readily available. This flexibility also makes the MS-1 well-suited for design applications, troubleshooting digital circuits and classroom demonstrations of digital logic principles.

The MS-1 Multiplexer Switch is available from stock in kit form for $59.95 and completely assembled for $74.95. Additional information may be obtained by contacting Mid-South Instrument Services, Inc., P.O. Box 1252, Gretna, LA 70053, (504) 393-0450.

CIRCLE INQUIRY NO. 212

8080 Microprocessor System Analyzer

The Model AQ8080 microprocessor system analyzer is effective as a design aid in prototype development and fault analysis of 8080 microprocessor-based products in production and field service.

The instrument provides a conditional hardware breakpoint with loop count and delay trigger provisions, 128 instruction program trace, and displays all address, data and status information. It also permits direct user interaction with memory, I/O ports and all registers.

The connection to the system being analyzed is easily accomplished with a buffer isolated probe terminated with a 40-pin clip that attaches directly to the microprocessor chip.

Price is $2,250. For further information contact AQ Systems, Inc., 1736 Front St., Yorktown Hts., NY 10598, (914) 962-4264.

CIRCLE INQUIRY NO. 213

Electronic Field Engineer's Tool Kit

An electronic-electrical service and repair kit, designated the JTK-18 Supervisor's Kit, contains more than 60 tools needed for field servicing and adjusting electronic equipment.

Included are screwdrivers, nutdrivers, pliers,

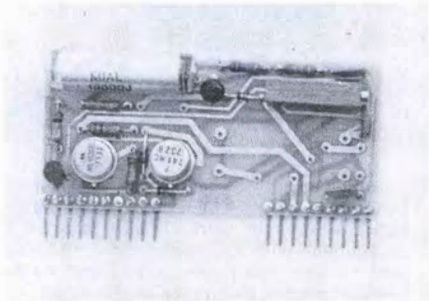
cutters, wrenches, spring tools, files, soldering equipment and more. A VOM meter is an optional accessory.

The JTK-18 sells for $277 complete with meter. Without the meter the price is $224.00. To order, or for further information, contact Jensen Tools and Alloys, 1230 S. Priest Dr., Tempe, AZ 85281, (602) 968-6231.

CIRCLE INQUIRY NO. 214

Series 300 Digital Panel Meter

The 8/16 Channel Differential Analog Multiplexer offers the user the capability to use one DPM for measurement of 8 separate differential signals, or 16 single ended signals.



The Peak and Hold Detector, used primarily for detecting and displaying the maximum level of a variable signal, offers 4 positive polarity input ranges from 200mV to 200V.

Single unit price for the Detector is $45; delivery is stock to three weeks. The unit price for the Multiplexer is $79 for single ended, and $89 for differential input. Delivery is stock to four weeks. For more information contact International Microtronics Corp., 4016 E. Tennessee St., Tucson, AZ 85714, (602) 748-7900.

CIRCLE INQUIRY NO. 215

Front Panel Program Analyzer for System 8 Microcomputer

The M80 Front Panel Program Analyzer provides complete on-line control and diagnostic capability for the M80 systems. The unique design of the analyzer allows the user to inspect and load the program counter, substitute instructions for those being retrieved from memory, and stop execution when the instruction at a specified location is executed or indicate instruction breakpoint without stopping execution.

M80 PROGRAM ANALYZER & ANALYZER INTERFACE MODULE

The M80 analyzer interfaces with the System 8 by means of a 60-pin connector plugged into an analyzer interface module in the system chassis. The M80 Front Panel Program Analyzer is priced at $750 in single lot quantities. Delivery is immediate.

For further information contact Warner & Swasey, Computer Div., 7413 Washington Ave. So., Minneapolis, MN 55435, (612) 941-4454.

CIRCLE INQUIRY NO. 216

Digital Pulser Probe

The DP-1 Digital Pulser from Continental Specialties Corporation, in addition to some substantial performance specifications, boasts a tiny bit of automation.

Internal circuitry monitors the node being probed, then presets the dual mirror output circuitry to pulse the node the other way. It delivers a strong enough pulse (50 ma in the CMOS mode, 100 ma in the TTL mode) to kick most lines with no need to desolder, unplug or isolate.

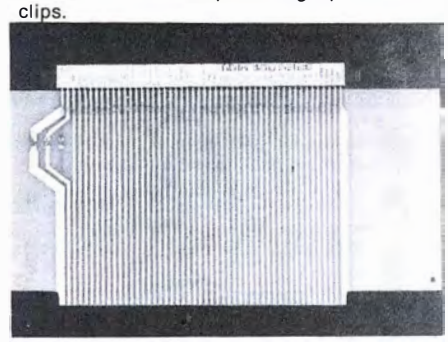
The Digital Pulser derives its power from the circuit being investigated to help assure logic level compatibility, and a switch selects appropriate threshold levels to trigger either TTL or CMOS circuits.

The price of the DP-1 Digital Pulser is $74.95. For additional information, contact Continental Specialties Corporation, 44 Kendall St., New Haven, CT 06509, (203) 624-3103.

CIRCLE INQUIRY NO. 217

S-100 Extender Board Kit

Digital Micro Systems is offering an extender board for ease of debugging your S-100 boards. It raises the board 5" allowing complete access to them with scope and logic probes or IC clips.



Extender board can remain in the computer with the cover on. It also has jumpers in the power supply lines for quick current measurements. Board has gold plated fingers and includes edge connector. Price is $16 less 16% introductory discount until December 31, 1977. Available from stock.

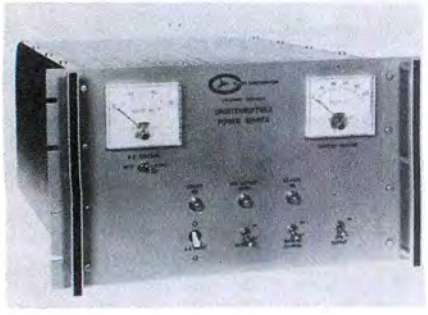
For more information, or to order, contact Digital Micro Systems, Box 1212, Orem, UT 84057, (800) 453-1444 or (801) 224-2102.

CIRCLE INQUIRY NO. 218

Power Supplies

"Mini-UPS"

The "Mini-UPS" series Uninterruptible Power System (UPS) protects critical loads from brown-outs, power line disturbances and loss of commercial AC power.



The "Mini-UPS" system features a unique solid state, convection cooled design, minimizing size, weight and audible noise generated by fans or blowers. The system is immune to input voltage variations of ± 15%.

Standard models have single phase outputs and are available in 625 VA, 1.25 KVA, 2.5 KVA and 5 KVA ratings. The unit is constructed for mounting in standard 19-inch rack or can be supplied in a stand alone cabinet.

Optional static bypass switch and battery packs are available. Prices start at $1650.00. For further information contact Clary Corporation, 320 W. Clary Ave., San Gabriel, CA 91776, (213) 287-6111.

CIRCLE INQUIRY NO. 219

Power Module Model DC150

Abbott's DC150 series of high efficiency switching regulated power modules are designed specifically for computer and computer peripheral applications in the telecommunications and interconnect industries. Input power is 41 to 52 VDC.

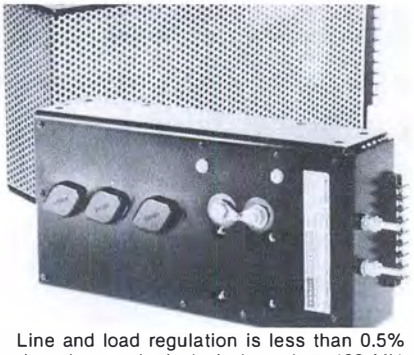
Line and load regulation is less than 0.5% and peak-to-peak ripple is less than 100 MV. Standard features include overvoltage protection, short circuit protection, overtemperature shut-down and remote error sensing.

Price is $350.00 for unit quantities and delivery is stock to ten weeks. For further information or Abbott's 1976-1977 Power Supply Catalog with complete details on other lines of modules, contact Abbott Transistor Laboratories, Inc., 5200 W. Jefferson Blvd., Los Angeles, CA 90016, (213) 936-8185.

CIRCLE INQUIRY NO. 220

Power Module Model NO. DC100

Abbott's DC100 series of high efficiency switching regulated power modules are designed specifically for computer and computer peripheral applications in the telecommunications and interconnect industries. Input power is 41 to 52 VDC.



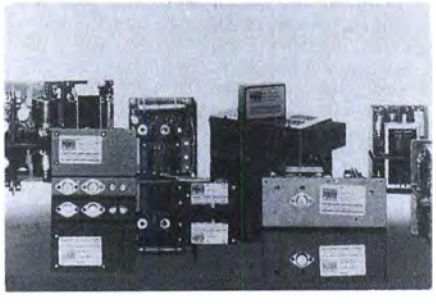
Line and load regulation is less than 0.5% and peak-to-peak ripple is less than 100 MV. Standard features include overvoltage protection, short circuit protection, overtemperature shut-down and remote error sensing.

Price is $325.00 (for unit quantities) and delivery is stock to ten weeks. For further information, or Abbott's 1976-77 Power Supply Catalog with complete details on other lines of power modules, contact Abbott Transistor Laboratories, Inc., 5200 W. Jefferson Blvd., Los Angeles, CA 90016, (213) 936-8185.

CIRCLE INQUIRY NO. 221

Power Supplies

Called "Application Display," the company groups its complete line of power supplies into four segments: computer, instrumentation, general electronics and industrial electronics. Power supplies are available for specific use with Bubble Memory, I^2L, T^2L, Floppy Disc, CMOS Logic, or OP-Amps, Microprocessors, Minicomputers, and Panaplex.



Models are available with single, dual, triple, and quadruple output. Voltage ranges are generally from 3 to 250 VDC; currents from 100 mA to 50 Amps; response time from 50 to 100 microsecongs; regulation ± 0.1% line and load; with a universal input of 115/250 VAC, 47-440 Hz (with exception of unregulated supplies).

For further information contact Standard Power, Inc., c/o Jansen Associates, inc., 1430 S. Village Way, Santa Ana, CA 92705, (714) 558-1172.

CIRCLE INQUIRY NO. 222

4 Output Switching Power Supply

A 4 output 50 watt switching power supply to drive microcomputer systems is offered by Boschert Associates. The standard supply has outputs of +5V@6A, ±12V@1A and −5V @1A, with a maximum power of 50 watts total.

This power supply offers the heat, weight and size advantages of a switching power supply with no cost penalty. Standard features include overvoltage protection and over current protection. This power supply offers a natural technological match for microcomputer systems. You can replace the 7-8 lb. boat anchor with a 14 oz. switcher and save 70% of the space and get 80% less heat as well.

All this and a price that is dollar for dollar competitive with low cost linears. Price for 100 each quantity is $99. Availability is 4 weeks ARO. For more information contact Boschert Associates, 384 Santa Trinita, Sunnyvale, CA 94086, (408) 732-2440.

CIRCLE INQUIRY NO. 223

Power Supply for KIM

The KL Model 512 Power Supply was primarily developed for MOS Technology KIM users, and for others needing a good 5 volt and 12 volt regulated supply. The Model 512 is completely assembled — not a kit.

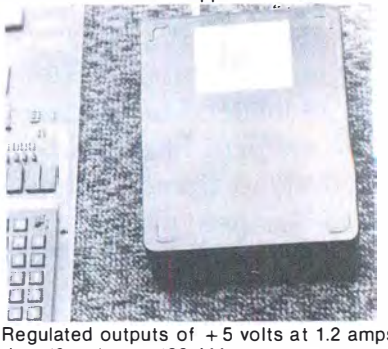
Total capacity of Model 512 is 4.5 amps. Other features are + 5V regulated with 1.4 amp max.; + 12V reg. with 1.0 amp max.; + 8V unregulated with 4.5 amp max.; + 16V unreg. with 1.0 amp max.; current limit and thermal overload protection on regulated outputs; fuse protected primary; AC line cord. The unit is enclosed in bakelite case with aluminum bottom plate and rubber feet. The connector cable is included.

Suggested retail price is $34. For further information contact KL Power Supplies, P.O. Box 86, Montgomeryville, PA 18936, (215) 257-8195.

CIRCLE INQUIRY NO. 224

KIM-1 Power Supply

The MTU model K-1000 power supply is designed to power the popular KIM-1 microcomputer board. It is totally enclosed in a black bakelite box which measures 5 9/16" wide by 6 13/16" long by 2 13/16" high overall. The line cord exit and output terminal strip are hidden under the box which is supported on rubber feet.



Regulated outputs of + 5 volts at 1.2 amps and + 12 volts at 100 MA meet worst case KIM-1 specifications. The regulated outputs have both current limit and thermal shutdown. An internal fuse protects against component failure and short to the unregulated outputs.

K-1000 Power Supply assembled and tested only, $40.00. For more information contact Micro Technology Unlimited, Box 4596, Manchester, NH 03108.

CIRCLE INQUIRY NO. 225

NOW WITH HARD DISK SUBSYSTEM

PUT A MACRO IN YOUR MICRO

THE NEW BREED OF MICROCOMPUTERS

The microcomputers have offered a tremendous economical advantage because of their standardization and versatility. Yet, they have lacked the power handling capabilities and software support of the minicomputer systems.

MicroAge™ now introduces a revolutionary new breed of microcomputers—retaining all the economical advantages and standardization of the microcomputers, yet, with the handling capabilities of the high power minicomputers.

SYSTEM FEATURES

Called the AM-100™, it is a 16-bit microprocessor CPU (2-card set) that replaces the 8080 microprocessor in your S-100 bus computer.

- Multi-user/Multi-tasking timesharing disk operating system.
- Disk file management system and utilities.
- Multi-user structured file system with passwords.
- AlphaBasic™ extended compiler and reentrant runtime software (not an interpreter).
- ISAM (index sequential access) as well as random and sequential data access.
- Free-form text editor and letter-writing text formatter.
- Fully supports most S-100 peripherals without modification.
- Up to 10 times the throughput of most 8-bit systems.
- Completely device independent with logical file I/O calls.
- System generation program to create custom operating monitors.
- Hardware supported totally relocatable object code.
- Eight 16-bit general purpose registers.
- Hardware floating point arithmetic to 11 significant digits.
- Multi-level direct memory access and vectored interrupt system.
- Real-time clock.
- Record type mapping system.
- Modular type program.

TIMESHARING FOR A MICRO

Imagine six people using the same microcomputer from different stations to perform different tasks. Imagine members of a computer club sharing the same microprocessor while each works from his own personal terminal.

Hardware limitations of the 8080 have made microcomputer timesharing impractical for the personal computer enthusiast. The AM-100™ 16-bit microprocessor set puts at your command a system which easily accepts multi-tasking from a multiple user structure. In addition the AM-100™ system lets you control priorities and allocate memory requirements for each job activated. There is even a security system to prevent unauthorized access to the data files (a Macro Computer?).

- Businessmen—put a terminal on the desk of your bookkeeper, stock clerk and design engineer. Perform the daily accounting, inventory control and design problems at the same time. Hook a terminal in the shop and audit production schedules with the processor's real-time clock.
- Teachers—have each student at a terminal at the same time running a learning program. Monitor the progress on your master terminal.
- OEM/Software Developers—create extremely fast executable object code format with source listing. Provide customized software for your customer in ALPHA BASIC™ without disclosing the source codes.

WESTERN DIGITAL MICROPROCESSOR

The AM-100 is based on Western Digital's advanced WD-16 microprocessor chip set. It has been re-microprogrammed to give a more flexible macro instruction set while still maintaining the general architecture and source code format on the popular PDP-11 series.

S-100 BUS COMPATIBILITY

The 16-bit processor system interfaces to the 8-bit S-100 bus by multiplexing through 70-plus TTL logic chips. This multiplexing is totally transparent to the programmer.

SYSTEM SUPPLIED

The Alpha Microsystem can be configured to any specification you require. It is supplied with the following items depending on your application and needs.

- AM-100™ CPU processor and all system software.
- S-100™ bus microcomputer mainframe and power supply (with or without addressable front panel).
- Persci dual floppy disk drives.
- AM-200™ floppy disk controller.
- Calcomp Trident hard disk drives of 25, 50, 80, 200 and 300 megabyte capacity.
- AM-400™ hard disk controller interface (up to four drives in any mix).
- Up to 60K primary RAM.
- SOROC IQ 120 text-editing CRT terminal.
- CENTRONICS line printers and terminals.
- Texas Instruments printers and terminals.
- All I/O interfacing hardware and drivers.
- AM-300™ six port serial interface.
- System diskette with AlphaBasic™ compiler.
- User documentation and manuals.
- Other languages including APL, LISP, FORTRAN, COBOL, and RPG as they become available.
- Business application software.

IN STOCK FOR IMMEDIATE DELIVERY

- Business application is now becoming available: Accounts Receivable, Accounts Payable, General Ledger, Payroll and Inventory.
- Conversion of your S-100 bus microcomputer starts as low as $1495 including full system software and AlphaBasic Compiler.
- MicroAge™ will provide you with the best support hardware in memories, terminals, printers and I/O systems.
- Delivery of complete systems is 30 days ARO.
- Allow 45 days ARO for hard disk and printers.
- Full 90 day system hardware warranty.
- User implementation is provided anywhere in the United States along with maintenance and service programs.
- Look to MicroAge™ to provide you with full consulting service for small business, scientific and educational computer systems.

Write or call us for further information and details, including user manuals.

Ask for our free 8 page brochure and price list:

MICROAGE™

803 N. Scottsdale Rd.
Tempe, Arizona 85281
Phone: (602) 894-1193
(602) 894-1129

See unit on display at our BYTESHOP retail stores:

813 N. Scottsdale Rd.	24 W. Camelback Rd.	12654 N. 28th Drive	2612 E. Broadway	1474 W. Spring Valley Rd.
Tempe, Arizona 85281	Phoenix, Arizona 85013	Phoenix, Arizona 85029	Tucson, Arizona 85716	Dallas, Texas 75080
(602) 894-1129	(602) 265-0065	(602) 942-7300	(602) 327-4579	(opening November 1)

CIRCLE INQUIRY NO. 65

Components

48-Position QUILL (Quad In-Line) Socket

Designed to accept the Motorola QUILL M10800 and Texas Instruments SN-74581 series of Bi-Polar L.S.I. devices, the new headers are low profile thermoplastic body Valox 420 SEO, UL 94VO listed, with four-leaf beryllium copper sockets for high retention. Closed-entry design prevents damage due to misalignment of the IC chip lead frame. Terminal sleeves are brass and are available with either gold-over-nickel or electrotin-over-copper plate. They are supplied with dip-solder terminals, P/N 860-48-CC-D, and .025-inch-square solderless wire wrap terminals P/N 860-48-AA-D.

The new QUILL (Quad In-Line) sockets are available in two to four weeks, at prices ranging from $1.00 to $2.50. For full information, use the Reader Service Card or contact Garry Manufacturing Co., 1010 Jersey Ave., New Brunswick, NJ 08902, (201) 545-2424.

CIRCLE INQUIRY NO. 226

TO-5 Impulse Solenoid

Artisan Electronics offers a miniature solenoid designed with body dimensions equivalent to that of the TO-5 transistor case.

Most applications for this TP-5 are for impulse duty — the generation of relatively high forces for short times or for pulsed operations on intermittent duty.

A typical coil for operation on 12VDC impulses would have a resistance of 1.5 ohms, pulsed at 12VDC with a maximum on-time of 25 milliseconds and a minimum off-time 130 times the on-time.

For more information contact Artisan Electronics, 5 Eastmans Rd., Parsippany, NJ 07054.

CIRCLE INQUIRY NO. 227

16-Button Keyboards

Ideal for multi-point remote control. Has 16 push buttons. 0 through 9, *, #, and A, B, C and D. Any number of keyboards can be connected on one pair of wires. Lockout feature — while one is being used others on pair of wires are locked out. Imagine — only one pair of wires need be connected to computer from these keyboards located anywhere on the premises. We have tested these over one mile of twisted 24 gauge phone wire, and they worked perfectly.

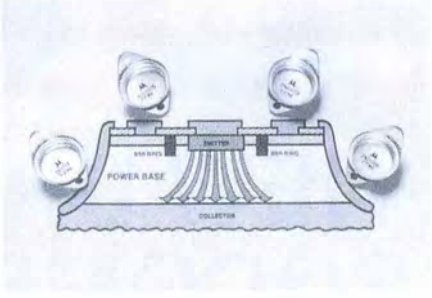
Also available, OPTO boards with 34 input opto isolators. Each OPTO has its own current limiting resistor that allows from 5 to 24VDC input voltage. Self scanning. Built in switch debounce. on board 64 byte FIFO buffer memory. Connects to any 8 bit parallel input port with handshake lines. Contains +5 and −12 voltage regulators. All I/O lines fully buffered.

For more information contact Gimix, Inc., 1337 W. 37th Pl., Chicago, IL 60609, (312) 376-0440.

CIRCLE INQUIRY NO. 228

PowerBase 2N3055H

Motorola offers PowerBase, a transistor which combines the rugged Safe Operating Area (SOA) specified for single-diffused-base types, with the economy and complementary structures of epitaxial-base devices.



This unique combination of characteristics is made possible be a process which reduces crowding of current into destructive "hot spots" by using a patented Base Spreading Resistance ring to produce more uniform current flow in a relatively thick epitaxial-base region.

Epitaxial production economy allows the PowerBase 2N3055H, with a SOA of 1.95A, 60V, to be priced at $0.69 in 1K quantities. Immediate delivery is from distributor and OEM stocks. For more information contact Motorola Semiconductor Products, Inc., P.O. Box 20912, Phoenix, AZ 85036, (602) 244-6900.

CIRCLE INQUIRY NO. 229

Numeric Pad Adds Flexibility

The Model 710 Numeric Pad is an easy way to increase the usefulness of GRI Model 753 or 756 keyboards. This easy-to-install accessory adds the convenience of numeric data entry at low cost and complexity, and does not require changes to existing wiring. The 710 wires directly into pads provided on the host keyboard, utilizing the existing ASCII encoder to provide 0-9 decimal data input, regardless of the main keyboard shift status.

All keyswitches are proven KBM series gold contact switches and are mounted on a rugged G-10 circuit board. Hookup takes only minutes, and the pad is easily mounted in existing enclosures or panels. The 710 Numeric Pad kit is $9.95 at local computer stores, or contact George Risk Industries, Inc., GRI Plaza, Kimball, NE 69145, (308) 235-4645.

CIRCLE INQUIRY NO. 230

Model 756 ASCII Keyboard

The GRI Model 756 full ASCII keyboard is designed to better meet the needs of personal, industrial and business microcomputer users. The 756 provides encoding for all 128 ASCII characters and control functions, imposing no limitations on software design, or hardware capability.

The versatile interface allows user selection of parity, positive or negative logic data and strobe outputs, alpha lock operation, and either DC level or pulse strobe signals. A latching shift lock key is included, and all outputs are TTL-DTL-MOS compatible.

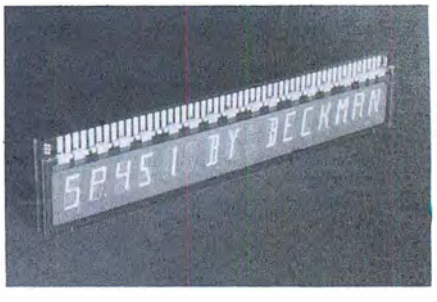
The 756K (kit) is $64.95 and the assembled and tested model 756 is $75.95 at computer stores across the country, or contact George Risk Industries, Inc., GRI Plaza, Kimball, NE 69145, (308) 235-4645.

CIRCLE INQUIRY NO. 231

0.5-Inch Gas Discharge Alphanumeric Display

Beckman's Model SP-451 planar gas discharge display takes advantage of screened-on-glass technology to accommodate up to 16 characters. Total display package measures 1.55 by 8.90 inch (39.4 by 226.1 mm).

Based on 14-segment design, messages consist of numerals, letters, and special symbols.



Character size, variety, brightness and 130° viewing angle recommend the SP-451 for its handsome neon-orange readability in bright, dark, or otherwise difficult conditions.

The SP-451 is designed for edgeboard mounting. The display requires only 0.8 inch, maximum, mounting depth, including tubulation.

Pricing for the SP-451 is $43.00 in the 100-499 quantity, or approximately $2.70 per digit. The CS-451, a compatible connector, is priced at $3.00 each in the same quantity.

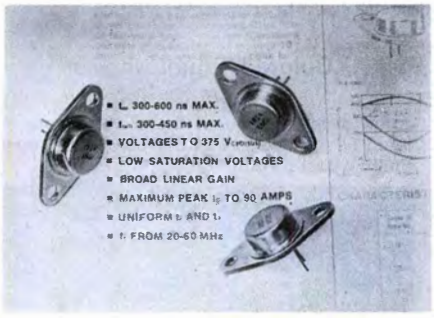
For more information contact Beckman Instruments, Inc., Information Displays Opera-

tions, 350 N. Hayden Rd., P.O. Box 3579, Scottsdale, AZ 85257, (602) 947-8371.

CIRCLE INQUIRY NO. 232

40W Fast-Switching Transistors Operate to 50MHz

Developed for power supplies, regulators and other switching applications, a new series of fast-switching NPN power transistors exhibit collector-emitter voltages from 200V to 375V with peak collector current of 10A.



The epitaxial-base transistors, designated the 1814 Series, by Solid State Devices, inc., have a maximum 600 nsec turn-on time and maximum 600 nsec fall-time for switching efficiencies to 50MHz. A linear gain of 20 across the entire current range reduces drive transistor requirements. Power dissipation at 25°C is 44W.

The 1814 Series, packages in TO-66 cases are priced from $10.00 each to $28.50 each in 100 quantities, depending on collector-emitter voltage requirements. Delivery is stock to 30 days. For more information contact Solid State Devices, Inc., 14830 Valley View Ave., La Mirada, CA 90638, (213) 921-9660.

CIRCLE INQUIRY NO. 233

40W Fast-Switching Transistors Operate to 50MHz

Developed for power supplies, regulators and other switching applications, a series of fast-switching NPN power transistors exhibit collector-emitter voltages from 200V to 375V with peak collector current of 10A.

The epitaxial-base transistors, designated the 1814 Series, have a maximum 600 nsec turn-on time and maximum 600 nsec fall-time for switching efficiencies to 50MHz.

The 1814 Series, packaged in To-66 cases are priced from $10.00 each to $28.50 each in 100 quantities. Delivery is stock to 30 days. For further information contact Solid State Devices, Inc., 14830 Valley View Ave., La Mirada, CA 90638; (213) 921-9660.

CIRCLE INQUIRY NO. 234

Boards, Boards, Boards

VIDEO Boards. Ultra high output. Generates 16 lines by 32 upper case characters. (Jumper selector for 16x64 for use with 10 MHz video monitor.) Dual port 1K (1024 bytes) RAM (can be jumpered to the beginning of any 1K memory segment) which the processor can read or write as though the memory was part of the system. Instantly displayed as written. Text scrolling and cursor generated by software. (Display driver software available.) Full interlace EIA video output (crystal controlled). Adjustable density and left hand margin. Designed for use on a master antenna system so that any TV on premise becomes a readout for the computer. More than one Video board per system can be used.

TONE RECEIVER Boards. Converts DTMF tones into binary. One per system required. Allows you to use tone buttons on phones (with our conversion boards) or our 16 button keyboards. Connects to 8 bit parallel input port.

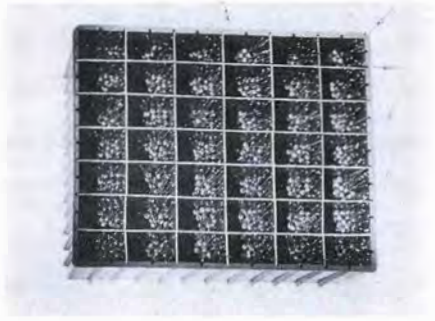
PHONE CONVERSION RELAY Boards allow you to convert your private phone system into computer terminals also.

For further information contact Gimix, Inc., 1337 W. 37th Pl., Chicago, IL 60609, (312) 376-0440.

CIRCLE INQUIRY NO. 235

Designer Resistor Sets

Energy Electronic Products announces new Designer Resistor Sets designated RS-25 (¼ W) and RS-50 (½ W). Each set consists of 20 resistors each of 42 values, 840 resistors total.



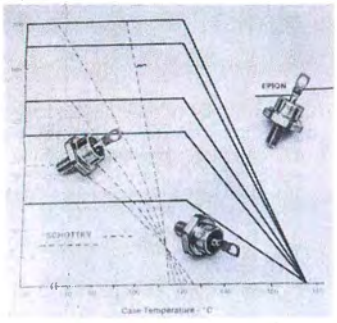
These high stability, low noise, top quality 5% carbon film resistors, at values from 68 ohm to 4.6 megohm, are available in a handy 42 compartment cabinet. A must for design engi-

neers and technicians. Available from stock at $24.90 for ¼ W and $25.90 for ½ W.
For further information contact Energy Electronic Products Corp., 6060 Manchester Ave., Los Angeles, CA 90045, (213) 670-7880.

CIRCLE INQUIRY NO. 236

Ion-Implanted Diodes

Two ion-implanted diodes provide the fast switching and low forward voltage associated with Schottky diodes while exhibiting better temperature characteristics, reverse leakage currents and an order-of-magnitude lower junction capacitance.



Designated the 1N6097E and 1N6098E, the device characteristics give significant efficiency improvement and reduced component count in conventional and switching power supplies to 100KHz. The E designator signifies that the diodes are manufactured with SSDI's proprietary EPION® ion-implantation process.

The 1N6097E is priced at $11.25 each and the 1N6098E is priced at $13.90 each, in 100 piece quantities. Delivery is stock to 4 weeks. For further information contact Solid State Devices, Inc., 14830 Valley View Ave., La Mirada, CA 90638; (213) 921-9660.

CIRCLE INQUIRY NO. 237

Pre-Trimmed A/D Converter

Burr-Brown's ADC82 is now available in a Q-screened version. Q-screening is Burr-Brown's stressing and testing sequence designed to meet increasing needs for extremely high product reliability.

The ADC82's specs, guaranteed after the 9-step Q-program, include 2.8 μsec max. conversion speed and accuracy better than ±0.2%, ±1LSB. The unit is also self-contained with internal clock, comparator and reference. No external gain or offset adjustments are needed for 0 to +10V or ±10V signal ranges.

The Q-screened units, designated ADC82AMQ, are priced at $89.00 (1-24), $74.00 (25-99) and $65 (100-249). For more information contact Burr-Brown, International Airport Industrial Park, Tucson, AZ 85734, (602) 294-1431.

CIRCLE INQUIRY NO. 238

Plastic VMOS Power FETs Offer MOS Benefits and Bipolar Pricing

The VNXXAF series of devices is made using Siliconix' vertical metal oxide semiconductor process (VMOS). Until the appearance of VMOS, MOS technology was restricted to small signal, low power applications. Now Siliconix' VMOS Power FETs bring MOS advantages to high power applications.

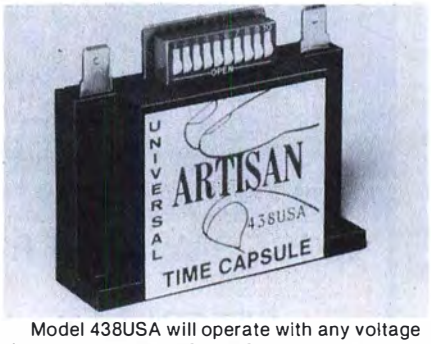
VMOS transistors can be used in almost every application that a power bipolar or Darlington transistor is used, plus many others. The high input impedance characteristic typical of MOS transistors makes VMOS a natural for interfacing to TTL, CMOS and MOS logic families.

For further information contact Siliconix Inc., 2201 Laurelwood Rd., Santa Clara, CA 95054, (408) 246-8000.

CIRCLE INQUIRY NO. 239

Programmable Time Delay

Artisan Electronics offers a time delay device "Universal Switch Adjustable Time Capsule®," Model 438USA, which has 10 programmable switches to permit the user to set the time delay period from 1 to 1024 seconds.



Model 438USA will operate with any voltage from 24-240 volts, AC or DC and with load currents to 1 amp. The unit is completely solid state, fully encapsulated and will function for millions of cycles.

Model 438USA measures 2.2" high x 2.3" long x 0.8" wide with the 10 switches mounted conveniently at the top. The unit is recognized by UL and is C.S.A. certified.

For more information contact Artisan Electronics, 5 Eastmans Rd., Parsippany, NJ 07054, (201) 887-7100.

CIRCLE INQUIRY NO. 240

Low-Noise Dual Preamps Available in Linear ICs

Three circuits are available, each incorporating two completely independent amplifiers with individual internal power supply decoupler-regulators.

Characteristics common to all the preamplifiers include: large output voltage swing (V_{CC}-2V p-p), wide power bandwidth (75KHz, 20V p-p), and operation from a single supply across the range of 9 to 40V.

The LM382 also provides 120 dB supply rejection and 60 dB channel separation, but open loop gain is 100 dB and total equivalent input noise is 0.8 microvolt.

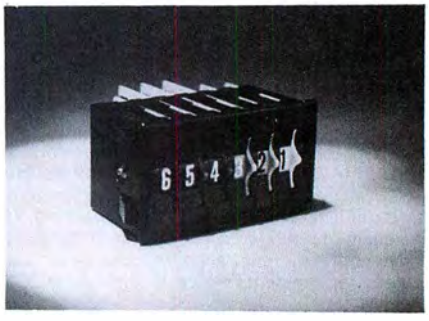
The new ICs are immediately available from stock through Signetics and its authorized distributors. Prices, in quantities of 100, are $1.50 for the LM381, $2.40 for the LM381A, $1.15 for the LM382, and 95¢ for the LM387.

For further information contact Signetics, 811 E. Arques Ave., Sunnyvale, CA 94086, (408) 739-7700.

CIRCLE INQUIRY NO. 241

Colored Thumbwheels on 8mm Switch

Six different colored thumbwheels are offered as options to EECO's 1800 Series 8mm thumbwheel Switch Product line.



Black, red, green, blue, yellow and natural white wheels aid in color-coding of front panel functions.

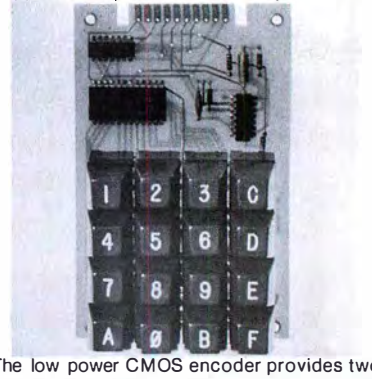
Price is under 25¢ per thumbwheel in 1,000 price quantities. 6-week delivery.

For more information contact EECO, 1441 E. Chestnut Ave., Santa Ana, CA 92701, phone: "Switch Marketing" (714) 835-6000.

CIRCLE INQUIRY NO. 242

Low-Cost HEX Keyboard

A fully encoded and ready-to-go hexadecimal keyboard uses the dependable KBM series gold contact keyswitches. The Model 716 HEX pad offers reliable HEX data input for control systems, microprocessor front panels, calculator applications, remote data entry, and more.



The low power CMOS encoder provides two-key rollover, latched data outputs, full debouncing and user selectable positive or negative logic data and strobe signals. The CMOS encoder is directly compatible with TTL and CMOS circuitry.

The pad is available in either kit or assembled form. Order No. 710K for $24.95, Model 710 (assembled and tested) for $27.50. Available at your local computer store or contact George Risk Industries, Inc., GRI Plaza, Kimball, NE 69145, (308) 235-4645.

CIRCLE INQUIRY NO. 243

"PRO" Keyboard

An all-new, truly-flexible keyboard specifically designed for personal computer, hobbyist and OEM users who don't want to work around a totally dedicated unit is available from Cherry Electrical Products Corporation.

Designated the "PRO," the keyboard

features a unique alpha lock key that changes outputs from typewriter to teletype code; five unassigned (non-dedicated) relegendable keys; is designed to piggyback a "daughter" board easily; and is designed for easy, do-it-yourself customizing.

For a free copy of the "Meet the PRO" 8-page brochure contact Cherry Electrical Products Corp., P.O. Box 718, Waukegan, IL 60085.

CIRCLE INQUIRY NO. 244

Form "C" DIP Switch

Large cross-section terminal pins on "Mini" DIP facilitate positive insertion into sockets and P.C. boards, while reducing the potential of misalignment and bending.

Unique locking design feature insures against accidental actuation. Positive wiping gold contacts.

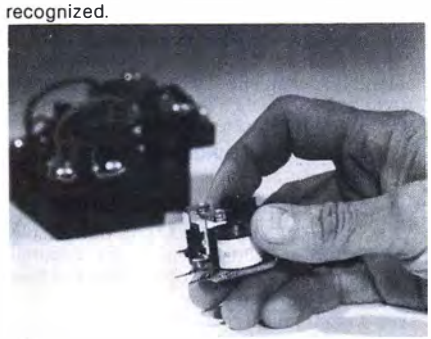
Retrofits other major brands of DIP switches due to standard .100 x .300 centers. Available in 1-5 station models; green body, white rocker, red marking. 2-station model priced under $1.90 in 1,000 piece quantities, 6-week delivery.

For further information contact EECO, 1441 E. Chestnut, Santa Ana, CA 92701 or phone "Switch Products" (714) 835-6000.

CIRCLE INQUIRY NO. 245

High Currents — Miniature Relays

The 30 ampere RB and RX series of relays are available with a choice of printed circuit, solder or quick disconnect terminations. They are available with either normally open or normally closed contacts. A selection of AC or DC coil voltages is available. The relay is UL recognized.



For technical or pricing information, please contact Artisan Electronics Corp., 5 Estmans Rd., Parsippany, NJ 07054, (201) 887-7100.

CIRCLE INQUIRY NO. 246

Instrument Grade IC Op Amp with Low Drift

The 3510 Precision Operational Amplifier offers designers very low drift plus an excellent combination of other key specifications for high-performance applications.

Production trimming assures a low input offset voltage drift of less than $\pm 0.5\ \mu V/°C$. Trimming also provides initial input offset (25°C) of less than $\pm 60\ \mu V$, often eliminating the need for external trimming circuits.

Packaged in a TO-99 case, the 3510 is available in three grades. The BM version provides the above mentioned specifications over the temperature range of -25 to $+85°C$. The AM version delivers $\pm 1\ \mu V/°C$ drift (max.) and $\pm 120\ \mu V$ offset (max.) over the range of -25 to $+85°C$. The RM version has the same spec's as the AM over the range of -55 to $+125°C$.

The 3510AM is $9.00 (1-24), $7.35 (25-99) and $5.95 (100-999). Prices for the 3510RM and BM are $14.75, $11.50 and $10.00 respectively. Delivery is from stock. For more information contact Burr-Brown, International Airport Industrial Park, Tucson, AZ 85734, (602) 294-1431.

CIRCLE INQUIRY NO. 247

Sumicon Multi-Pin Connector

The SUMICON multi-pin connector is a single action quick release connector in 20, 34 and 45 pin configurations. The unique feature of interchangeable male and female inserts (male shown in detail in photo) gives the user great flexibility in all applications.

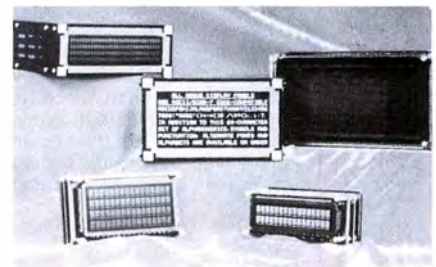
Already in standard use in VTR and camera applications, the silver plated contacts are rated to 350 VAC, at 3 amps.

Plated mild steel chassis bracket occupies only 1¼" x ⅝" (20 pin version). Prices commence at $17.00 for complete 20 pin plug and chassis assembly in single lot. For more information contact John Anthony Television, Microcomputer and Hobbyist Products, Childs Park Road, Dingmans Ferry, PA 18328, (717) 828-7480.

CIRCLE INQUIRY NO. 248

Alphanumeric Display Subsystems

IEE-ARGUS Alphanumeric Display Subsystems utilize dot matrix message panels (DC-excited plasma) to provide a display of characters in 5 x 7 dot matrix format with standard underline and cursor capability.



All subsystems are available in either neon-orange or green. Synchronous, asynchronous, and addressed-location loading modes make

the systems extremely versatile, yet interfacing is simple and straight forward.

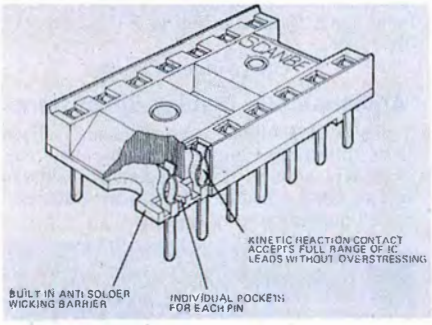
Each complete system is compactly housed with multiple mounting methods provided. Optional accessories such as universal input power supplies, contrast enhancement filters, mating connector and cable assemblies, and serial data converters are available.

For more information or a free catalog contact IEE, 7740 Lemona Ave., Van Nuys, CA 91405, (213) 787-0311.

CIRCLE INQUIRY NO. 249

New Patent on Socket

Scanbe, Division of Zero Corporation, has been issued a patent by the U.S. Patent Office for the company's low-profile solder socket, designated Model US-2. The Patent No. 4,033,656 was issued July 5, 1977.



The patent features a dual fulcrum contact which, by improving stress distribution and utilizing the socket body as one of the fulcrum points, results in the highest possible contact holding pressure. Scanbe's edge-wipe contact design ensures ideal insertion and withdrawal forces, even after multiple insertions.

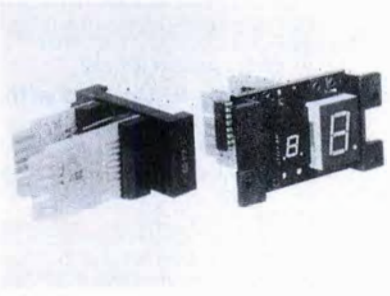
The socket is offered in popular sizes from 8 to 40 pins, with or without gold in and with .110" ot .160" length pins. The US-2 is sold in both domestic and foreign markets.

For detailed information on the newly patented socket, either write or pnone Scanbe Marketing Services, 3445 Fletcher Ave., El Monte, CA 91731, (213) 579-2300.

CIRCLE INQUIRY NO. 250

LED Display Decoder/Driver

The Series 1760-OX IEE-ATLAS LED Display Decoder/Driver is designed to be integrally mounted onto the back of IEE-Atlas Display Mounting Hardware Series 1750/1751/1752-OX (wire-wrap terminal models).



These decoder/drivers will accept either four line BCD or serial, plus count inputs; all models incorporate an inherent memory capability. Model 1760-01, -03 is the decoder/driver with memory, while Model 1760-02, -04 has memory and counter.

Series 1760-OX can be used with standard PC connector or directly solder terminated. In 500-piece quantities, 1760-01, -03 is $7.35 each and 1760-02, -04 is $9.60 each. Delivery is off the shelf. For more information contact IEE, 7740 Lemona Ave., Van Nuys, CA 91405, (213) 787-0311.

CIRCLE INQUIRY NO. 251

Audio Amplifier for Distributors

Energy Electronics Products Corporation announces blister packed audio power amplifiers for dealers and distributors. Colorful and attractively packed for easy display.

The initial introduction consists of 4 amplifiers 10, 20, 30 and 50 watt models. Complete data and application printed on back of card. The amplifer makes an "instant amp" in minutes. For further information contact Energy Electronic Products Corp., 6060 Manchester Ave., Los Angeles, CA 90045, (213) 670-7880.

CIRCLE INQUIRY NO. 252

Literature

Short Form Catalog Describes SSDI's Power Semiconductor

A new four-page short-form catalog lists 20 multi-purpose high-voltage rectifiers with peak reverse voltages to 5000V, 18 high-voltage glass-passivated fast-recovery diodes with 250 nsec recovery times and eight EPION® ultra-fast recovery rectifiers with recovery times from 9 nsec to 75 nsec and forward currents from 1A to 100A. Included are six high-voltage plastic assemblies with peak reverse voltages from 2000V to 8000V.

The catalog also describes 17 classes of SSDI's EPITRON® high-speed epitaxial power transistors with peak collector currents from 10A to 65A and sustained collector-emitter voltages from 40V to 350V.

For the brochure or more information contact Solid State Devices, Inc., 14830 Valley View Avenue, La Mirada, CA 90638; (213) 921-9660.

CIRCLE INQUIRY NO. 253

New Teaching Tool

The first wave of professionally-prepared learning materials specifically for small stand-alone computer systems is now in preparation at Educulture, Inc., a California-based educational publisher. The new programs, aimed primarily toward secondary and post-secondary education, include comprehensive, coordinated series in mathematics, English and the sciences.

As initially configured, the programs are designed to run on machines with 32K bytes of RAM, single-drive digital tape or flexible disc storage, and medium-resolution CRT displays (512 x 512 to 720 x 1024 addressable points). The presence of graphic capabilities, which allow the use of pictures, diagrams, and the special characters and symbols of mathematics and science, is felt to contribute materially to the pedagogical effectiveness of the programs.

For further information contact Educulture, INc., 3184 "J" Airway Ave., Costa Mesa, CA 92626, (714) 751-2113.

CIRCLE INQUIRY NO. 254

Minicomputer Breadboard Catalog Available

A free 32-page catalog describing over one hundred different breadboards for use by prototyping engineers is available from Douglas Electronics, 718 Marina Blvd., San Leandro, CA 94577. In addition to a complete line of general purpose breadboards, connectors, and racks, the catalog shows minicomputer interface boards which are compatible with DEC, Data General, Camac, Computer Automation, and S-100 hardware systems. Boards are carried in stock for immediate shipment.

For further information contact Douglas Electronics, Inc., 718 Marina Blvd., San Leandro, CA 94577, (415) 483-8770.

CIRCLE INQUIRY NO. 255

Proceedings of 1977 National Computer Conference Available Through AFIPS Press

The hardcover publication contains 132 original papers which were presented June 13-16 in Dallas, Texas. Copies are available at $60.00 each from AFIPS Press, 210 Summit Avenue, Montvale, New Jersey 07645. Members of AFIPS Constituent Societies will receive a 50 percent discount if the order is prepaid.

The papers contained in the 1,000-page Proceedings deal with such topics as: Data Base Administration, Computer Systems Architecture, Computer Graphics, Clinical Applications of the Computer, Microprocessor Architectures, Software Management, Computer Hardware Design, Data Structures, Applications of Computer Networks, Personal Computing, International Networks and Packet-Switching, Programming Languages, Multi-Microprocessor Computer Systems, Fault-Tolerant Computing, Software for Users and Managers, Special Memory Architectures, The Computer in Management and Business, and Computer Security Risk Assessment.

CIRCLE INQUIRY NO. 256

Microcomputer Workshops Brochure

A brochure describing the current series of Intel Microcomputer Workshops is available from Intel Corporation.

New workshops on the RMA/80™ Real-Time Multi-Tasking Executive software system for SBC 80 Single Board Computers and on programmable peripheral devices begin this fall. Other workshops cover the MCS-80/85™ system, MCS-48™ system, PL/M language programming, and Series 3000 bipolar system.

For the brochure, write: Literature Department, Intel Corporation, 3065 Bowers Ave., Santa Clara, CA 95051.

CIRCLE INQUIRY NO. 257

The First Book of KIM

176 pages of information and recreation including:

—Dozens of programs: games, diversions, educational, utility and diagnostics; all with detailed documentation.
—Beginner's guide to programming KIM — elementary programming and debugging.
—Guide to KIM expansion — principles and commercial products.
—Sensing and controlling external devices.

PLUS: reference material, resource data, and

hints and tips on using the KIM. Order your copy today . . . send $9.00 to: ORB, P.O. Box 311, Argonne, IL 60439. Outside North America, add $1 postage. Personal checks must clear before shipment is made.

CIRCLE INQUIRY NO. 258

Fastest Connector Assembly Machine Literature Available

Molex Incorporated announces a four-page bulletin describing the world's most unique connector assembly machine . . . the Molex 2742 Mark II, now available.

The connector assembly machine is designed to automatically prepare insulated wire to varying lengths, crimp a terminal to one end of these wires and assemble the terminated wire to a connector housing in a predetermined circuit arrangement, at a rate of 3600 wires per hour.

For more information, contact Molex Incorporated, 2222 Wellington Ct., Lisle, IL 60532.

CIRCLE INQUIRY NO. 259

User Manual for Tape Cassette Controller

Extensive documentation that will aid users of NEC Microcomputer's μPD371 magnetic tape cassette/cartridge controller is now available from the company, based here.

The 58-page users manual, offered at $10, provides design engineers and systems developers with a complete product description, including timing and circuit diagrams. In addition, the manual contains a complete assembly language listing of the data handling routines for NEC's 8080A microprocessor.

The μPD371 controller uses the ANST, ECMA and ISO standard phase encoding recording technique. It is a high-performance, N-channel single-chip controller for interfacing up to two cassette cartridge drives. The 371 drives can be driven by most processors, including NEC's own 8080A microprocessors, as well as by 6800, 6502 and Z-80 microprocessors.

For further information contact NEC Microcomputers, Inc., 5 Militia Dr., Lexington, MA 02173, (617) 862-3434,

CIRCLE INQUIRY NO. 260

Thyristor Gating Report Available

"Thyristor Gating for Microprocessor Applications," an 11-page report, is available free from Texas Instruments, Incorporated.

Bulletin CA-191 covers the use of the most common thyristors, triacs and SCRs, in microprocessor-based control systems for appliance and industrial control applications. Particular emphasis is given to a microwave oven application.

Provided are brief descriptions of a triac and SCR along with schematics showing polarity relationship between gate and anode. The report points out that the gate drive current can be either pulsed or DC and further explains when the thyristor reaches a turn off point.

This booklet provides a general discussion of microprocessor control of triacs. It alerts designers to major factors involved in coupling the microprocessor output to the thyristor.

For further information, contact Texas Instruments, Incorporated, IAS, P.O. Box 5012, M/S 308 (Attn: CA-191), Dallas, TX 75222.

CIRCLE INQUIRY NO. 261

Brochure on Medical Applications

"Computers In Medicine," a new brochure from Digital Equipment Corporation, describes applications of PDP-11 computer systems in records management, data analysis and test reporting for hospitals and other medical organizatons.

The publication discusses the MUMPS-11 multi-terminal medical information system, the GAMMA-11 system for data acquisition, analysis and display in nuclear medical applications, and the Programmable Data Logger (PDL) for clinical laboratory test data collections, storage, calculation and reporting.

To obtain a copy of "Computers In Medicine," request Brochure EA 06119 from Communications Service, Digital Equipment Corp., 444 Whitney St., Northboro, MA 01532.

CIRCLE INQUIRY NO. 262

Complete Payroll Program with Cost Accounting for $12.50

The first of three new books of business data processing programs in BASIC by Osborne & Associates. *Payroll with Cost Accounting* — in BASIC is a total payroll program, including complete, tested, source listings, file layouts, file maintenance programs, interactive operator data entry sequences, screen display formats, and report printout formats. The book includes a user manual, program flow charts, and narrative descriptions. Other books in this series will include: *Accounts Payable and Accounts Receivable* (available January, 1978) and *General Ledger* (available March, 1978).

These programs are all written in Wang Laboratories standard BASIC and may be keyed directly from the book into a Wang computer. For other variations of BASIC, some programming changes will be required.

For further information, contact Osborne & Associates, Dept. C, P.O. Box 2036, Berkeley, CA 94702.

CIRCLE INQUIRY NO. 263

Complete Product Catalog

The new 80-page General Computer Catalog contains descriptions and prices on the complete range of hardware, software, components and literature available.

Included are the products of over fifty of the leading manufacturers in the microcomputer field. Purchase of this catalog will bring you periodic updates throughout the year.

Send $2.00 to The General Computer Company, 420 Main St., Brighton, MI 48116.

CIRCLE INQUIRY NO. 264

Software

Software on Cassettes

COMPU-QUOTE announces its Computer Cassettes — a line of pre-recorded software available on high-quality, low-noise Phillips cassettes. At present, four different cassettes are offered — 4K BASIC, 8K BASIC, VIDEO CHECKERS, and GAMES. All are recorded in the popular Tarbell format and are intended for 8080 microcomputer systems. The GAMES and VIDEO CHECKERS tapes play under MITS 8K BASIC (version 3.1). Complete documentation is supplied.

Available immediately from COMPU-QUOTE, 6914 Berquist Ave., Canoga Park, CA 91307.

CIRCLE INQUIRY NO. 265

EMPL/8080 Interpreter

EMPL, a micro APL for the Z-80/8080, is now available. The interpreter itself resides in 5.5K bytes, but a minimum of 8K is recommended. EMPL has numeric and character vectors, user-defined monadic and dyadic functions, 22 primitive functions, 9 system commands, and many other special operators and characters. EMPL can be run either in the ASCII or APL character set. The range is 232767—double-byte integer arithmetic is used. EMPL is $10, including a Tarbell cassette an User's Manual. Contact Erik Mueller, Britton House, Roosevelt, NJ 08555, (609) 448-2605.

CIRCLE INQUIRY NO. 266

Altair™ Software Package

MSG/CIS is a unique business software package developed by the Altair Software Distribution Company. It allows for efficient storage and retrieval of customer names, addresses and other pertinent information. Up to 1800 customer files may be stored on each diskette, categorized, filed and sorted. When retrieved, customer file information can be printed out in either list format or on labels.

The included sorting routines permit the user to classify the Masterfile or any temporary file into ascending or descending order by name, address, organization, zip code or other parameters. Convenient diskette backup procedures are provided to guard against data loss.

MSG/CIS offers complete control over customer file listings and label printing. Labels of any size may be used since all vertical and horizontal spacing is user definable. Full editing and updating capabilities help to keep your files current. For more information contact MITS, Inc., 2450 Alamo S.E., Albuquerque, NM 87106.

CIRCLE INQUIRY NO. 267

Business Software in BASIC

Software Unlimited, Ltd., is making available full and complete software packages written in BASIC intended to run on personal computer systems for nearly every business application including accounts receivable, accounts payable, inventory, payroll, medical billing, general ledger, mailing lists, and so forth. The various packages require from 16 to 24K of system memory and require a mass storage device, preferably dual floppy. Some of the software is configured to run with a single floppy or with an alternate mass storage device such as a tape cassette system.

Software prices vary upon the application and the form in which they are provided. The business programs are available in listing form, on standard floppy discs, or mini-floppy or in several cassette formats, as well as in 8-level punched paper tape.

For further information, write Software Unlimited, Ltd., P.O. Box 232, Manlius, NY 13104.

CIRCLE INQUIRY NO. 268

ANSI Standard FORTRAN IV

Technical Design Labs announces a complete ANSI Standard FORTRAN IV for a microcomputer.

Operationally, this FORTRAN is a disc-oriented system. It runs in less than 24K with DOS, and both FDOS IV and CP/M versions are available.

This complete ANSI STANDARD FORTRAN IV package includes both the floppy diskette with object code and a user's manual. Additional documentation and support packages are available. It is priced at $349.

For further information, contact Technical Design Labs, Inc., Research Park, Bldg. H, 1101 State Rd., Princeton, NJ 08540, (609) 921-0321.

CIRCLE INQUIRY NO. 269

National Software Exchange, Inc.

National Software Exchange, Inc. was recently organized as a software clearing house to provide an interface between buyers and sellers of software. The corporation will operate primarily in the micro and minicomputer area.

Mechanics of the system are simple: For a small annual fee a program owner may register and set the price for a particular program. National Software Exchange, Inc. requires certification of ownership or certification the program is in the public domain. Also the owner must give a money back guarantee of user satisfaction.

National Software Exchange registers the program into one of six categories, and monthly, publishes a program description in a category catalogue. The catalogues are widely advertised and distributed both individually and by subscription.

Program buyers are required to sign a non-disclosure agreement, and are provided a copy of the program at the price set by the author plus a small copy fee.

For more information contact National Software Exchange, Inc., 1000 Lake St. Louis Blvd., Suite 248, Lake St. Louis, MO 63367, (314) 625-2400.

CIRCLE INQUIRY NO. 270

Expanded BASIC Software Package

Micropolis Corporation has expanded its Disc Extended BASIC software package to provide additional support for BASIC programming with its new million-byte Model 1054 MetaFloppy system.

The expanded BASIC includes a flexible new CHAIN command, which allows the user to segment very large programs and run the segments in any order. Thus, the new command permits running of programs which are larger than the memory of the computer by using the disc as intermediate storage.

Standard business-oriented features of Micropolis Disc Extended BASIC include variable precision arithmetic, complete STRING and substring capability and extensive disc file commands.

The new Micropolis BASIC is designed for 8080/Z-80 based microcomputers having at least 24K bytes of RAM. For further information contact Micropolis Corp., 7959 Deering Ave., Canoga Park, CA 91304, (213) 703-1121.

CIRCLE INQUIRY NO. 271

North Star Executive Software

XEK, a complete system executive package for North Star users, is now available from the Byte Shop of Westminster, CA.

The XEK package contains a disassembler capable of creating files that may be left in memory when changing from the disassembler to the executive package for re-assembly. The monitor software has the ability to accept input from cassette tapes and paper tape as either source or object files, as well as from the North Star diskette system. In addition, the assembler features a new auto-line editor for the creation of source files. This editor also extends to the modification of existing object files.

Another feature is the XEK's ability to handle up to six named files at once that may be consecutively assembled to form one object file. The assembler, monitor, and disassembler come with complete documentation, both on disc and as a manual. Total price, including first class postage, insurance and California residents' sales tax, is $48.00.

For further information and ordering, contact The Byte Shop of Westminster, 14300 Beach Blvd., Westminster, CA 92683, (714) 894-9131.

CIRCLE INQUIRY NO. 272

Two Software Packages for 6502 Computers

CGRS Microtech introduces two software packages:

EXOS, "extended operating system" for the 6502. The EXOS software package operates with 6502 computers such as the CGRS Micro-6000 and features commands such as DISPlay memory, ENTEr into memory, FIND specified data, MATH calculations, TEST memory, COMPare, LOAD, VERify, MOVE memory and USER-go to user program. EXOS is available on four programmed 2708 EPROMs and supplied with user documentation.

DATE, "Disassembler, Assembler, Trace and Debug Editor" provides the resident software for quick programming and debugging of 6502 computers. Source code programs can be entered, assembled-edited-debugged and even disassembled. DATE is available on four programmed 2708 EPROMs or an MOS Technology T.I.M. format paper tape.

For further information, contact CGRS Microtech, P.O. Box 368, Southampton, PA 18966.

CIRCLE INQUIRY NO. 273

Business Control Applications

Software Dynamics BASIC, a compiler version of the popular programming language, is available for 6800 microprocessor systems.

Decimal arithmetic, formatted output and file input/output make SD BASIC ideal for micro business applications such as payroll and inventory.

High speed binary arithmetic, transcendental functions, assembly language interface and the performance resulting from compiling BASIC programs makes SD BASIC an excellent tool for building process control programs.

Readable variable names, IF-THEN-ELSE statements, multiple statements per line and error trapping aid program design and maintenance.

SD Compiler BASIC is currently available on American Microsystems MDC, Smoke Signal Broadcasting BFD-68, Electronic Products Associates, Midwest Scientific Instruments, SWTP and Wave Mate microcomputers. If your 6800 is not included on this list, the I/O Interface Package concept will allow you to easily customize SD BASIC to your DOS system.

For further information contact Software Dynamics, 17914 S. Laurelbrook Pl., Cerritos, CA 90701, (213) 926-6492.

CIRCLE INQUIRY NO. 274

Miscellaneous

LSI-11 and PDP8/11 Wire-Wrappable Boards Interface with DEC Micros and Minis

The CIP4 and CIP4/11 wire-wrappable module boards plug directly into, and are "bus-compatible" with, standard DEC "Omnibus" and "Q-Bus" Systems.

The CIP4 and CIP4/11 univeral wire-wrappable boards provide 32 columns of 60 low-profile socket terminals per column with alternate rows of committed ground and voltage wire-wrappable terminals. These boards will accommodate up to 110 16-position I.C. chips or an equivalent mix of 14-, 16-, 18-, 22-, 24-, 28-, 36-, or 40-position I.C. chips.

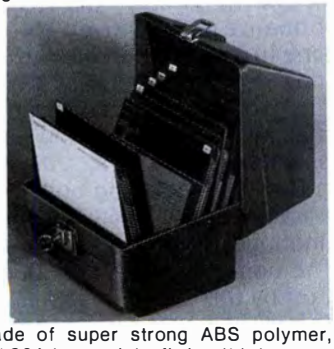
The new CIP4 and CIP4/11 interfacing boards are available in Dual, Quad, and Hex sizes at prices ranging from $1.50 to $2.00 per I.C. position.

For complete information please use the Reader Service Card or contact Garry Manufacturing Co., 1010 Jersey Ave., New Brunswick, NJ 08902, (201) 545-2424.

CIRCLE INQUIRY NO. 275

FLEX 80A

Floppies are flexible, they need support to keep them from sagging, slumping and warping — factors that cause a permanent distortion of the disc and prevent retrieval of information. The FLEX 80A is designed so that discs cannot slip down in the case as they do in a half-used box of discs. A unique system built in the case supports the discs without the force of compression — another element that damages discs.



Made of super strong ABS polymer, the FLEX 80A has a tight fitting lid that provides protection from dirt, dust and environmental contamination that affect not only the disc but also the reader head.

Equipped with a key lock for file integrity, the FLEX 80A is a handy, compact storage module. It has an indexing system that keys discs to a Master Card for quick reference and retrieval. Capacity: 50 discs and envelopes. Color: Walnut. For further information, contact Advance Access Group, Inc., 10526 W. Cermak, Westchester, IL 60153, (312) 562-5210.

CIRCLE INQUIRY NO. 276

"Plato" Has Added Computer Memory

Intel's in-458 memory system has added more than a million semiconductor memory words to the "Plato" computer system's extended core memory. The Intel memory makes it possible to expand the "Plato" user base from 1000 to 1250 terminals.

"Plato" is an educational system accessed by classes in colleges, universities, junior colleges, high schools, elementary schools, and military installations throughout the United States and Canada.

The in-458 added 1,048,576 more 60-bit words to the Plato system's two million word capacity, giving Plato a new memory capacity of more than three million words. The basic storage unit in the system is the Intel MU-58, a 32K x 8 bit storage unit using Intel 2107B 4K x 1 bit dynamic RAMs.

For further information, contact Intel Memory Systems, 1302 N. Mathilda Ave., Sunnyvale, CA 94086, (408) 745-7120.

CIRCLE INQUIRY NO. 277

Microprocessor Protection

Lightning and heavy-duty electrical equipment often creates power-line surges and transients. These can cause extensive damage to valuable microprocessors and peripherals.

Electronic Specialists is announcing a line-cord transient suppressor which will absorb repeated power surges, protecting delicate equipment.

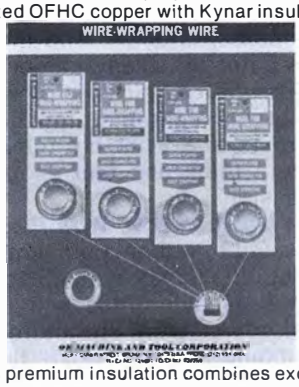
Available in 2 prong plug/socket ($11.50) or 3 prong plug/socket ($14.50), these units are also available with integral power line hash filtering.

For more information contact, Electronic Specialists. Box 122. Natick. MA 01760.

CIRCLE INQUIRY NO. 278

Wire-Wrapping Wire

Finest industrial quality AWG30 (0,25mm) wire-wrapping wire is now available on compact, convenient 50' (15m) rolls. Perfect for small production applications, prototype jobs or amateur electronics projects, the wire is silver plated OFHC copper with Kynar insulation.

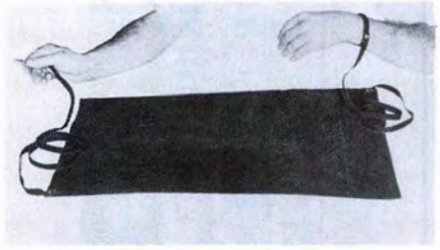


This premium insulation combines excellent electrical and mechanical characteristics with easy stripability and is available in 4 colors: red, white, blue and yellow. Packaged on 1⅝" (40mm) diameter spools for easy handling and storage. Available for immediate delivery. For further information contact OK Machine and Tool Corp., 3455 Conner St., Bronx, NY 10475.

CIRCLE INQUIRY NO. 279

Anti-Static Work Station for Field Service of Computers

An anti-static work station for use by field service personnel repairing computers, peripherals or other equipment incorporating microcircuits has been announced by Wescorp.



The W-9010 Field Service Work Station has a conductive woven cotton wrist strap and conductive grounding strap permanently attached to a conductive felt work bench cover measuring 18 x 24 inches.

When the work station is grounded the wrist strap drains static electricity from the wearer before he can touch a circuit board equipped with an MOS device. Removing circuit boards from electronic equipment usually leaves them without the impedance that protects MOS's from static electricity damage or destruction when the circuit board is installed.

Price of the W-9010 is $13.95 and delivery is immediate. Further information is available from Wescorp, 1601 Stierlin Road, Mountain View, CA 94040.

CIRCLE INQUIRY NO. 280

Mini-Rack Low Boy

This is a product in which to rack mount a combination of computer and computer related equipment in a stylish Mini Rack low boy enclosure or in a modern looking stand up Maxi Rack.

Standard options are available such as removable side and rear panels, doors, venting, adjustable RETMA rails, casters, cable cut outs, and others to allow you to fit our product to your particular needs. The Mini Rack is modular so that one or more can be used under one top providing maximum space for system expansion and operator work area.

A variety of colors is available to blend with any decor. Reasonable delivery times, personal service, plus ease of assembly are several added reasons to contact Electronic Systems Furniture Company, 1215 E. El Segundo Blvd., El Segundo, CA 90245, (213) 322-4612.

CIRCLE INQUIRY NO. 281

BOOK REVIEWS

I'M MADLY IN LOVE WITH ELECTRICITY AND OTHER COMMENTS BY WOMEN IN SCIENCE AND ENGINEERING

Nancy Kreinberg. Lawrence Hall of Science, 1977.
37 pages. $1.00, paper.
Review by Judy Scolney Robertson and Larry Robertson

I'm Madly in Love With Electricity is hardly the type of book one would expect to see reviewed on these pages. Nonetheless, it is a stimulating book, provocative and refreshing in its open approach to opportunities for women in the sciences. The information in this booklet was gathered from numerous women working in engineering, mathematics, physics, astronomy, chemistry and the life sciences. Their various comments are often quoted directly as they discuss the problems and pleasures they have encountered in seeking employment and maintaining their professional status in traditionally male fields.

The title comes from a quote by Amelia Sue Marshall, a first year engineering student who talks about her disadvantaged status because of a lack of higher mathematics (notably algebra and trigonometry) and physics in high school. Although her situation is not uncommon, many young women would not go on in the face of such handicaps and be able to say, as Ms. Marshall does, "I would definitely advise young women to enter electrical engineering, but then, I'm madly in love with electricity . . ."

This frank discussion of opportunities for women in the sciences and engineering is directed toward young women who are just making their career choices. And the book does point out many career possibilities often overlooked by women. It is also enlightening for the male reader to see what his female coworkers think and feel about their professions.

I'M Madly in Love With Electricity is packed full of encouragement for the aspiring female scientist or engineer. It is also filled with advice about course work the future scientist should take before starting college, summer jobs, career opportunities, and problem areas. You could hardly do a kinder favor for the young woman interested in science or engineering or one who is floundering in her career decisions than to send for a copy of *I'm Madly in Love With Electricity* for her. The book is available only by mail from Lawrence Hall of Science, University of California, Berkeley, CA 94720; Attention: Careers.

COMPUTERS, COMPUTERS, COMPUTERS IN FICTION AND IN VERSE

Dennie L. VanTassel, Editor. Thomas Nelson, Inc., Publishers, 1977. 192 pages. $6.95.
Review by Judy Scolney Robertson and Larry Robertson

In *Computers, Computers, Computers in Fiction and in Verse,* Dennie VanTassel, author of *The Compleat Computer* (reviewed earlier this year), has again collected a magnificent assortment of amusing and thought provoking computer lore. VanTassel includes eighteen of Gloria Maxson's "Glorobots," a delightful collection of limericks which have appeared in *Datamation.* He also has accumulated eighteen short stories (mostly of science-fiction variety), poems and articles written by authors ranging from Art Buchwald to Renn Zaphiropoulos.

Computers, Computers, Computers is pleasant reading for anyone, whether he is "into" computers or not. The book can be picked up for a quick break in routine activities, or read as we did, in one sitting. Science-fiction fanatics will be delighted with Barbara Paul's "Answer 'Affirmative or 'Negative'." "Put Your Brains in Your Pocket" by Arthur W. Hoppe is an absolutely fantastic satire on pocket calculators and some implications for their future use. Michael Shaara's "2066: Election Day" is a gripping but frightening commentary on civil service examinations and the computer.

The non-enthusiast may find he's put off by the title, but reading *Computers, Computers, Computers* may arm him for battles with his computerist friends. Not all of this collection is pro-computer. It is, however, all quite intriguing. Not to mention mind-expanding.

VanTassel's *Computers, Computers, Computers in Fiction and in Verse* cannot be recommended highly enough, either for its amusement value or its varied perspectives on the computer and society.

Software Section

By Robert A. Stevens and Robert S. Jones

In the past this Software Section has been edited by Robert A. Stevens whose association with us was on an independent consulting basis. Mr. Stevens is President of Automated Computer Systems of Pasadena. He also initiated and operates the Microcomputer Software Depository which has always been and continues to be an entity independent of this publication.

We are happy to announce that the Software Editor function of this magazine will now be executed in-house on a full-time basis by Dr. Abraham A. Perez, whose involvement with digital computers dates back to the late Forties when programming was done entirely in binary. Dr. Perez spent several years on electronic circuit and electromechanical component development work in the early development period of electronic data processing systems such as IBM 701, BICA, and BIZMAC. Another long period of time was spent as a logic designer leading to directed system design of a number of commercial data processing systems. Before the advent of MOS technology, he lead development efforts in ultra-compact computers for commercial and military applications.

During the last twenty years, Dr. Perez alternated his technical activities between formal studies and design application of various information technologies such as signal processing techniques, database management, data communications and display, software documentation, communication management and machine linguistics. He has experience in areas as varied as real-time software operating systems, operational trainers, specification of high order programming language, medical and geophysical data instrumentation and processing, military and industrial command and control systems, computer-generated displays, word and document processing, computer-aided design, interactive computing in research and design in several engineering disciplines of the aerospace manufacturing industry such as structures, thermodynamics, propulsion, flight mechanics and control, flight test and evaluation and engineering program management.

Our new Software Editor is a member of about fifteen professional and scientific societies and has chaired committees for professional meetings and conferences, among which were at least a half dozen computer conferences dating back to 1954. He is the recipient of the Distinguished Service Award from the AIAA.

Dr. Perez describes his career in these words: "I have been in the field since the days when computer programs were the product of a black art, and in which the steps required for the production of software were vaguely defined. In those days the status of software development projects was even more ambiguously described. This was partly because of lack of techniques for software documentation as well as lack of appreciation for the need for such documentation.

"A piece of computer software may be error-free at some point in time when the software developer feels that he has adequately validated and verified his output on a particular machine configuration and operational environment. However, as the operational environment — requirements - and machine configurations change, there is a need to change or maintain the software to keep it operational within a new environment and hardware configuration.

"Without adequate and suitable documentation, software cannot be maintained by anyone else other than the original designer and implementer — and that only if he has a good memory and has kept adequate notes of his design."

Our new Software Editor spends his leisure time browsing through technical literature or optimizing application programs on his personal computer. He holds multiple baccalaureates in mathematics, civil, electrical and mechanical engineering, multiple advanced degrees in physics, earth sciences, operations research and systems engineering. He studied at the University of the Philippines, University of Philadelphia and MIT where he received his doctorate in physics.

NOVEMBER SOFTWARE SUMMARY

Like all other past issues of INTERFACE AGE, this one contains a wealth of software which includes two development programs, a business application program, two music application programs, and a game program. A summary of this software is as follows:

- **CONVBASE — GETTING DOWN TO BASES** by Irwin Doliner, provides us with a number base conversion software development program.
- **MWNBCP — NUMBER BASE CONVERSION** program developed by Mark Winkler, provides the reader of INTERFACE AGE with still another number-base conversion software development program.
- Part 3 of **GENERAL LEDGER PACKAGE,** which lists the General Ledger programs. The total software package developed by Bud Shamburger provides the small businessman with a complete and fully documented general ledger business application software package for the 8080 microcomputer system.
- **CSBOM — A BYTE OF MUSIC** application program developed by Christopher Smith provides a brute force programming technique requiring only one memory byte to program both the note frequency and duration parameters.
- **DVBMM — MOLYPROCESSOR MUSIC** application software by Darrel Van Buer provides another version of coding music into a microcomputer language.
- **KBBG — BLOCKADE** game program developed by Kenneth Berkum provides a video game that can be played by two people. Blockade is an 8080 computerized version of the ATAR1 coin-operated game.

Molyprocessor Music

by Darrel J. Van Buer

INTRODUCTION

For those interested in computer produced music, the accompanying programs present a novel combination of music playing, music editing and multiprogramming. This system is a cooperative effort of the following three distinct programs:

- Music Player Program
- Supervisor Program
- Interactive Music Editor Program

The actual system code is in memory from addresses 000-070 through 002-151. The program for one task is in addresses 000-000 through 000-067; and for the other at 002-152 through 002-331 and 003-256 through 003-271. The remainder of memory is devoted to tables for the music routines used as a demonstration.

MUSIC PLAYER PROGRAM

The first of these, the music player, located in the first 28 bytes of memory (through 000:033), plays a list of coded notes in memory. This is done by modulating bus switching noise made audible by a nearby AM radio. When it reaches the end of a musical score, it simply restarts the tune and continues.

SUPERVISOR PROGRAM

The second program, located from 000:070 to 002:151, is a supervisor program which handles keyboard interrupts and schedules the running of the other two programs. Its scheduling algorithm is to run the editor program following each interrupt for the time needed to process the character, and to run the music player whenever the editor is not running. The effect of the interrupt processing on the music playing is barely noticeable.

INTERACTIVE MUSIC EDITOR PROGRAM

The third program, located from 002:152 to 002:322, is a simple interactive music editor which builds music scores for the tune player in response to keyboard entries. This function includes the translation of the keyboard notation for music into the form required by the music player. This conversion is partly controlled by the table located from 003:232 to 003:163 in memory.

CODING SCHEMES

The music follows two different coding schemes, one for external use, the other for internal use. In the music player, each note is stored as a number which represents the oscillation period. This number is used as the loop counter in one of the player's loops. Because each note is stored in only one byte, the dynamic range is limited to about three octaves because the low numbers used for high notes limit the resolution between notes. To obtain true pitches, these numbers must be adjusted for differences in CPU and memory speed, but for many purposes, a scale with the proper relationship between notes is adequate.

The keyboard input to the music editor is coded in an easily readable manner. The digits '1', '2' and '3' are used to signal one of three octaves, each of which runs from C up through the next higher B, with '1' designating the lowest octave. Once an octave has been chosen, it applies to all notes typed until another octave is selected. The letters A, B, C, D, E, F and G stand for the notes they name within the octave. When a pound sign (#) is typed, the last note typed is changed to the corresponding sharp note. Since there is no B# or E#, the command is ignored for these notes. Typing a blank inserts a rest into the score while typing a backslash ( ) deletes the last note in the current score. Typing an X deletes the entire score from memory so that a new tune can be started.

MUSIC PLAYER NOTE TRANSLATION

The translation of the notes to the form required by the music player is mostly table-driven. The note table in memory has three parts, one for each octave used. One of these octave tables is selected for future table lookup whenever an octave selection digit is entered. Each of these octave tables is a list of the note values for the music player in the order A, A#, B, B#, C, C#, D, D#, E, E#, F, F#, G, G#. To simplify indexing, the table has space for B# and E# even though there are no such notes. These entries contain the values for B and E respectively. When a letter is typed for a note, double its value is used to compute the offset into the table to obtain the translated note. The address of the table entry is saved for use when a pound sign is typed. The pound sign routine simply skips to the second byte of the pair for the letter typed, which contains the sharp note, if any. Because octave order to the letters is not alphabetical, but the table is indexed alphabetically, the value of the three highest notes in an octave (A, A# and B) appear in the table before the remainder of the notes to code those notes properly.

SOFTWARE SYSTEM ORGANIZATION

Control of the system is maintained by four kinds of control blocks, Task control blocks (TCB), Event control blocks (ECB) also called semaphors, Unit control blocks (UCB), and a communications vector table (CVT).

Task Control Blocks Task control blocks contain the essential information about each of the many things the system is doing. TCBs are linked together with pointers and so may be anywhere in writable memory. The TCB indicates whether the task is ready to run or waiting for some event. If a task is waiting, it also lists the events which must occur. Since each task has its own stack and stack pointer value, the TCB saves this address when the task is not running.

Event Control Blocks Event control blocks are used to synchronize tasks with each other and with external events (interrupts). An ECB is a single byte treated as a signed integer whose value is the number of times an event has happened. Waiting for an event decreases the value of an ECB by one. An ECB with a negative value means one or more tasks are waiting for an event which has not yet occurred.

Unit Control Blocks Unit control blocks contain information about I/O devices. Their contents varies with the kind of device, but will generally contain the most recent control byte inputs and outputs and the event control blocks which will be posted by various device events such as successful data transmissions or error conditions. The programming example has two UCBs which support an MC6850 ACIA such as used on a MITS 2-SIO board.

Communications Vector Table The communications vector table contains information of system-wide importance. At present, the CVT contains pointers to the beginning of the list of TCBs in the system and to the TCB for the task currently running on the CPU.

SYSTEM PROGRAM STRUCTURE

There are two parts to the system programs, the interrupt handling routines and the system services routines.

Interrupt Handling Routines The interrupt handling routines are entered following each interrupt and interrogate each device which could generate the interrupt. The routines then clear the interrupting condition and signal the appropriate ECBs for the external events.

System Services Routines The system services routines are entered by calls to a standard vector following the RST instruction area. There are currently three services: SVC1 or wait, SVC2 or post, and SVC12 or disabled post. Wait is used to wait for an event as reflected in an ECB. If an ECB indicates the event has already occurred, an immediate return is taken. Otherwise, the TCB is marked for the waiting condition and the task will not run again until the event does occur. Wait takes a list of possible events, any one of which will satisfy the wait request. When an event does happen, the location of the ECB posted is returned to identify it.

Both post and disabled post serve to signal an event via an ECB. If a task has been waiting for the event, it will be made ready to run. There are two differences between them, however. To use disabled post, the calling program must have disabled interrupts first (with DI instruction) and will always return control to the caller. With the regular post, the call will usually be made with interrupts enabled, and if the post results in making another task ready to run, control may not return for some time. It is also true in general that if an interrupt occurs, the running task can lose control without warning. If control must not be lost, a program must either run disabled to interrupts or run at a higher priority than other tasks. Priority of tasks is determined by their order in the list of tasks, with the first being the highest.

ADDRESS	OCTAL CODE	TAG	MNEMONIC	EXPLANATION
000-000	041	RETUNE	LXI H,	Starting address of tune.
000-001	365		TUNE	
000-002	002			These loops modulate the bus switch-
000-003	176	NEWNOTE	MOV A,M	ing harmonics, can be tuned well into
000-004	376		CPI	short-wave bands of nearby radios.
000-005	377		255	End of Tune?
000-006	312		JZ	Yes, go restart it
000-007	000		RETUNE	
000-010	000			
000-011	026		MVI D,	Set duration of note
000-012	040		32	
000-013	005	COUNTF	DCR B	B counts audio cycle
000-014	302		JNZ	
000-015	020		BISOK	
000-016	000			
000-017	106		MOV B,M	Restore counter
000-020	015	BISOK	DCR C	Duration sub-counter
000-021	302		JNZ	
000-022	013		COUNTF	
000-023	000			
000-024	025		DCR D	Duration counter
000-025	302		JNZ	Continue this note
000-026	013		COUNTF	
000-027	000			
000-030	043		INX H	Advance note pointer
000-031	303		JMP	and play next note
000-032	003		NEWNOTE	
000-033	000			
000-056	000	STACK2		(E) This stack saves status of the tune
000-057	016			(D) playing task when suspended
000-060	175			(C) the values presented here for the
000-061	006			(B) registers are the values they had
000-062	027			(F) at the last interrupt before I
000-063	055			(A) stopped the computer.
000-064	002			(L)
000-065	003			(H)
000-066	014			PC_L
000-067	000			PC_H
000-070	363	RESET7	DI	All interrupts come here. DI in case
000-071	345		PUSH H	bad prog runs in non-memory= all 1's.
000-072	365		PUSH PSW	Save all status in (my) standard order
000-073	305		PUSH B	
000-074	325		PUSH D	
000-075	303		JMP	Jump to actual interrupt service
000-076	150		RS7	
000-077	000			
				These gaps in memory are reserved for future system features.
000-103	303	SVC01	JMP	System routine jump vector
000-104	120		SVC1	Jump to system wait routine (to see if

```
000-105  001                                    an event occurred, and if not, wait).
000-106  303  SVC02    JMP                      Jump to system post routine (to
000-107  302                    SVC2            announce an event has occurred).
000-110  001
000-111  076  INITIAL  MVI A,                   Start program here after loading.
                                                Insures orderly system startup.
000-112  003                            3       Reset command for 2-SIO ports
000-113  323           OUT                      Reset port 0
000-114  000           0
000-115  323           OUT                      Reset port 2
000-116  002           0
000-117  076           MVI A,                   Port 0: RCV INT ENAB, RTS, XMIT
                                                INT ENAB,
000-120  271           10111001B                8 data, even parity, 1 stop, div by 16
000-121  062           STA                      Save control in UCB
000-122  016           CTLOUT0
000-123  001
000-124  323           OUT                      and send to port.
000-125  000                            0
000-126  076           MVI A,                   Port 2: RCV INT ENAB, RTS, XMIT
                                                INT ENAB.
000-127  251           10101001B                7 data, even parity, 1 stop, div by 16
000-130  062           STA                      Save control in UCB
000-131  027           CTLOUT2
000-132  001
000-133  323           OUT                      and send to port (for 300 baud terminal)
000-134  002                            2
000-135  303           JMP                      Jump to system dispatcher to find a
                                                ready
000-136  035           DISPATCH                 Task
000-137  001

000-144  303  SVC012   JMP                      System jump vector: for disabled post
000-145  347                    SVC12
000-146  001

000-150  315  RS7      CALL                     Call device routines
000-151  211           DEV7
000-152  000
000-153  072           LDA                      Check post flag. Did interrupt post a
000-154  275           REDEFL                   waiting task?
000-155  001
000-156  247           ANA A                    Test for zero
000-157  302           JNZ                      Non-zero means did post
000-160  170                    SUSP
000-161  000
000-162  321           POP D                    Restore status and return
000-163  301           POP B
000-164  361           POP PSW
000-165  341           POP H
000-166  373           EI                       Allow next interrupt
000-167  311           RET                      Return to interrupted routine

000-170  041  SUSP     LXI H,                   Get stack pointer value
000-171  000           0                        by DAD to zero
000-172  000
000-173  071           DAD SP
000-174  353           XCHG                     Hold SP value in DE
000-175  052           LHLD                     Get location of TCB for current task
000-176  070           CVTCTC                   Saved in the CVT
000-177  001
000-200  001           LXI B,                   Offset to SP field in TCB
000-201  006           TCBSTK-
000-202  000           TCBTCB + 2
000-203  011           DAD B

000-204  371           SPHL                     Put in SP
000-205  325           PUSH D                   Push SP value into TCB
000-206  303           JMP                      Go dispatch highest priority ready task
000-207  035                    DISPATCH
000-210  001
000-211  333  DEV7     IN                       Check port 0 for interrupt
000-212  000                            0
000-213  041           LXI H,                   Location of control byte in save in UCB
000-214  017                    CTLIN0
000-215  001
000-216  167           MOV M,A                  Save control byte
000-217  007           RLC                      Rotate INT bit to carry
000-220  322           JNC                      If not set, try other boards
000-221  313                    NXTDEV2
000-222  000
000-223  346           ANI                      Test RCVR full (LSB) (rotated above)
000-224  002                            2
000-225  312           JZ                       Jump if not full
000-226  243                    NORCV0
000-227  000
000-230  333           IN                       Read data from port
000-231  001                            1
000-232  062           STA                      And save in UCB

000-233  020                    DATAIN0
000-234  001
000-235  041           LXI H,                   Get address of ECB to post for data
000-236  021                    INECB0           received.
000-237  001
000-240  303           JMP                      Jump to system disabled post (will
000-241  144                    SVC012           return to RS7)
000-242  000
000-243  176  NORCV0    MOV A,M                  Get status byte again
000-244  346           ANI                      Test xmiter empty
000-245  002                            2
000-246  312           JZ                       If not, interrupt must be because DCD
000-247  300                    LOSTCAR0         went high
000-250  000
000-251  021           LXI D,                   See if transmitter interrupts on
000-252  016                    CTLOUT0
000-253  001
000-254  032           LDAX                     D
000-255  346           ANI                      Isolate RTS and XMIT INT ENAB
000-256  140                    01100000B
000-257  376           CPI                      And test for enabled
000-260  040                    00100000B
000-261  302           JNZ                      If disabled, INT was for DCD loss
000-262  300                    LOSTCAR0
000-263  000
000-264  032           LDAX D                   XMIT INT, so disable it
000-265  346           ANI                      Turn off XMIT INT ENAB, leave RTS
000-266  337                    11011111B        and all other control options the same
000-267  022           STAX D                   Put new value back in UCB
000-270  323           OUT                      and send to device. (Turn bit back on
000-271  000                            0       when byte is output)
000-272  041           LXI H,                   Post out ECB for interrupt
000-273  022           OUTECB0
000-274  001

000-275  303           JMP                      and jump to disabled post
000-276  144                    SVC012
000-277  000
000-300  333  LOSTCAR0  IN                      Clear interrupt by data read (after
000-301  001                            1       control read above)
000-302  062           STA                      Save data byte in UCB

000-303  020                    DATAIN0
000-304  001
000-305  041           LXI H,                   Post status change ECB
000-306  023                    STATEC0
000-307  001

000-310  303           JMP                      Jump to disabled post
000-311  144                    SVC012
000-312  000
000-313  333  NXTDEV2   IN                      Test status byte of device 2
000-314  002                            2
000-315  041           LXI H,                   Get addr of status IN in UCB
000-316  030                    CTLIN2
000-320  167           MOV M,A                  Save control status
000-321  007           RLC                      Rotate INT bit to carry
000-322  320           RNC                      Return if, no interrupt
000-323  346           ANI                      Test rcvr full
000-324  002                            2
000-325  312           JZ                       Jump if not full
000-326  343                    NORCV2

000-327  000
000-330  333           IN                       Read new data
000-331  003                            3
000-332  062           STA                      Store it in UCB
000-333  031                    DATAIN2
000-334  001
000-335  041           LXI H,                   Post ECB for reception of byte
000-336  032                    INECB2
000-337  001
000-340  303           JMP                      Jump to disabled post
000-341  144                    SVC012
000-342  000
000-343  176  NORCV2    MOV A,M                  Get status in again
000-344  346           ANI                      Test XMIT empty
000-345  002                            2
000-346  312           JZ                       If not empty, DCD has gone high
000-347  000                    LOSTCAR2
000-350  001
000-351  021           LXI D,                   See if XMIT interrupts enabled
000-352  027                    CTLOUT2
000-353  001
000-354  032           LDAX D                   Get last control out
000-355  346           ANI                      Isolate XMIT interrupt control bits
000-356  140                    01100000B
000-357  376           CPI                      See if enabled
000-360  040                    00100000B
000-361  302           JNZ                      If not, loss of carrier
000-362  000                    LOSTCAR2
000-363  001

000-364  032           LDAX D                   is on, so turn off till next out data
000-365  346           ANI
000-366  337                    11011111B
000-367  022           STAX D                   Save change in UCB
000-370  323           OUT                      and send to device
000-371  002                            2
000-372  041           LXI H,                   Post the output in ECB
000-373  033                    OUTECB2
000-374  001
000-375  303           JMP                      Jump to disabled post
000-376  144                    SVC012
000-377  000
001-000  333  LOSTCAR2  IN                      Read data channel to clear interrupt
001-001  003                            3
001-002  062           STA                      Save data in UCB
001-003  031                    DATAIN2
001-004  001
001-005  041           LXI H,                   Post status change ECB
001-006  034           STATEC2
001-007  001
001-010  303           JMP                      Jump to disabled post
001-011  144                    SVC012
001-012  000

001-013  011  UCBOLEN   DCB 9                   Length of unit control block (UCB)
001-014  001  TYPE0     DCB 1                   2-SIO port. UCB tabulates all device
                                                data
001-015  000  PORT0     DCB 0                   I/O device code of port
001-016       CTLOUT0   DSB                     Last control byte written
001-017       CTLIN0    DSB                     Last control byte read
001-020       DATAIN0   DSB                     Last data byte read
001-021  377  INECB0    DCB -1                  Event control block (ECB) -1 = 1 task
                                                waiting for event to occur. Posted on
                                                reception
001-022  377  OUTECB0   DCB -1                  ECB for transmitter empty
001-023  377  STATEC0   DCB -1                  ECB for status change
001-024  011  UCB2LEN   DCB 9                   Length of UCB
001-025  001  TYPE2     DCB 1                   2-SIO port.
001-026  002  PORT2     DCB 2                   I/O device code of port
001-027       CTLOUT2   DSB                     Last control byte written
001-030       CTLIN2    DSB                     Last control byte read
001-031       DATAIN2   DSB                     Last data byte read
001-032  377  INECB2    DCB -1                  ECB for data reception
001-033  377  OUTECB2   DCB -1                  ECB for transmitter empty
001-034  377  STATEC2   DCB -1                  ECB for status change
001-035  052  DISPATCH  LHLD                    Get location of first TCB from CVT
001-036  066                    CVT1TC
001-037  001
001-040  371  CHAIN     SPHL                    Use SP to access current TCB
001-041  341             POP H                  Get link to next TCB
001-042  361             POP PSW                Get dispatchability flags from TCB
001-043  302             JNZ                    Try next TCB if not ready
001-044  040                     CHAIN
001-045  001                                    Fall out and dispatch if ready
001-046  321             POP D                  Get saved stack PTR from TCB
001-047  041             LXI H,                 Recompute location of this TCB
001-050  372                     -6             Offset the three pops
001-051  377
001-052  071             DAD SP                 TCB location now in HL
001-053  042             SHLD                   Save its location in CVT for next
001-054  070             CVTCTC                 time we stop current task
001-055  001
001-056  353             XCHG                   Move SP value toward SP
001-057  371  DISPX      SPHL                   Restore task's stack ptr
001-060  321  DISPXX     POP D                  Restore its registers
001-061  301             POP B
001-062  361             POP PSW
001-063  341             POP H
001-064  373             EI                     Back to interruptible status
```

```
001-065  311                RET             and back to task
001-066  100  CVT1TC        DCA TCBTCB1     Pointer to first TCB in system
001-067  001                                (highest priority)
001-070  110  CVTCTC        DCA TCBTCB2     Pointer to current TCB (highest priority
001-071  001                                ready task)
001-072  377  CVTHIC        DCA 3-337       Pointer to highest RAM address in
001-073  003                                system
001-100  110  TCBTCB1       DCA TCBTCB2     Pointer to next lower priority TCB
001-101  001                                Task control block (TCB) for forground
001-102  200  TCBDSP1       DCB 200         Waiting (200) or Ready (100)
001-103  006  TCBWTC1       DCB 6           Length of ECB list for wait
001-104  320  TCBSTK1       DCA 2-230       Redispatch SP value
001-105  002
001-106  256  TCBELS1       DCA ECBL        Pointer to ECB list for wait
001-107  003
001-110  000  TCBTCB2       DCA 0           No lower priority TCB. Background
001-111  000                                music playing task
001-112  100  TCBDSP2       DCB 100         Ready
001-113       TCBWTC2       DSB             Reserved for wait count
001-114  056  TCBSTK2       DCA 0-056       Stack during last interrupt
001-115  000
001-116       TCBELS2       DSA             Reserved for wait list PTR
001-117
001-120  345  SVC1          PUSH H          Wait routine. Enter with HL pointing to
001-121  365                PUSH PSW        ECB list, acc size of list. Task will
001-122  305                PUSH B          be ready after any one is posted
001-123  325                PUSH D          Save registers
001-124  041                LHI H,          Get SP value
001-125  000                    0
001-126  000
001-127  071                DAD SP
001-130  353                XCHG            Free HL
001-131  052                LHLD            Find current TCB
001-132  070                    CVTCTC
001-133  001
001-134  001                LXI B,          Add offset to SP field in TCB
001-135  004                    TCBSTK1-
001-136  000                    TCBTCB1
001-137  011                DAD B
001-140  363                DI              Disable while changing ECB's, we
001-141  163                MOV M,E         can't allow interrupts (and post's)
001-142  043                INX H           Put SP value into TCB
001-143  162                MOV M,D
001-144  353                XCHG
001-145  042                SHLD            And in our private storage to allow fast
001-146  273                    RESMSP      resumption if posted ECB found now
001-147  001
001-150  062                STA             Save list size in local storage
001-151  275                    LISTCNT
001-152  001
001-153  341                POP H           Run back up stack to ECB list PTR(HL)
001-154  341                POP H           Skip other entries
001-155  341                POP H
001-156  341                POP H           Finally get to HL
001-157  042                SHLD            and save it locally
001-160  276                    LISTADR
001-161  001
001-162  371                SPHL            Move to SP for fast list run-through
001-163  341  LOOP1         POP H           Next ECB pointer from list
001-164  065                DCR M           Wait = -1, if was posted, non-negative
001-165  362                JP              result so will immediately return
001-166  230                NOWAIT
001-167  001
001-170  075                DCR A           Count thru ECB list
001-171  302                JNZ             Test all in list
001-172  163                    LOOP1
001-173  001
001-174  052                LHLD            None were ready, so change dispatch-
001-175  070                CVTCTC          ability flags
001-176  001
001-177  043                INX H           Skip link field
001-200  043                INX H
001-201  176                MOV A,M         Get current flags
001-202  346                ANI             Turn off dispatchability (Z/NZ IN F)
001-203  277                    277         During dispatch, flags are poped into F
001-204  366                ORI             Turn on wait flag (P/M IN F)
001-205  200                    200
001-206  267                MOV M,A         Put back in TCB
001-207  043                INX H           to wait count in TCB
001-210  072                LDA             Get count
001-211  275                    LISTCNT
001-212  001
001-213  267                MOV M,A         and move to TCB
001-214  001                LXI B,          Move up to ECB list field in TCB
001-215  005                    5
001-216  000
001-217  011                DAD B
001-220  371                SPHL            To SP for push
001-221  052                LHLD            Get list location
001-222  276                    LISTADR
001-223  001
001-224  345                PUSH H          Push list value into TCB
001-225  303                JMP             Go dispatch new ready task
001-226  035                DISPATCH
001-227  001
001-230  107  NOWAIT        MOV B,A         Save count of untested ECB's
001-231  072                LDA             Get total count. We only want to decre-
001-232  275                    LISTCNT     rement the posted one, so must undo
                                            same.
001-233  001
001-234  220                SUB B           Total number decremented
001-235  353                XCHG            Save ECB posted
001-236  052                LHLD            and go put in stack so that upon return
001-237  273                    RESMSP      from wait call, HL points to ECB
                                            posted.
001-240  001
001-241  001                LXI B,          Offset to HL in stack
001 242  006                    6
001-243  000
001-244  011                DAD B
001-245  163                MOV M,E         E
001-246  043                INX H
001-247  162                MOV M,D         H
001-250  052                LHLD            Now fo and fix up ECBs
001-251  276                    LISTADR
001-252  001
001-253  371                SPHL            into SP for fast scan
001-254  312                JZ              Test sub 6 at 1-234 above
001-255  265                    DISPDIR     If zero, ECB was first in list
001-256  001                                otherwise there are some to fix
001-257  341  LOOP2         POP H           Pointer to next ECB
001-260  064                INR M           Re-increment ECB (restore it)
001-261  075                DCR A           Count off fixup
001-262  302                JNZ             Loop till all done
001-263  257                    LOOP2
```



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001-264  001
001-265  052  DISPDIR       LHLD            Restore stack pointer
001-266  273                    RESMSP
001-267  001
001-270  303                JMP             and go share restore code w/dispatcher
001-271  057                    DISPX
001-272  001
001-273       RESMSP        DSA             Temporary storage in WAIT/POST
              SPSAV
001-275       LISTCNT       DSB             Temporary storage in WAIT/POST
              REDEFL
001-276       LISTADR       DSA             Temporary storage in WAIT/POST
              CURTCB
001-300       SEMSAV        DSA             Temporary storage in POST
001-302  363  SVC2          DI              Enabled POST. Disable to prevent re-
                                            entry
001-303  315                    CALL        Call disabled POST to actually do post
001-304  144                        SVC012
001-305  000
001-306  365                PUSH PSW        Save ACC over test
001-307  072                LDA             Did post find task waiting?
001-310  275                    REDEFL
001-311  001
001-312  247                ANA A
001-313  302                JNZ             Jump if did post a waiting task
001-314  321                    SUSPEND     (Go save status and dispatch)
001-315  001
001-316  361                POP PSW         Restore ACC
001-317  373                EI              Back to normal interrupt status
001-320  311                RET             Return to post caller
001-321  361  SUSPEND       POP PSW         Restore register
001-322  345                PUSH H          and save all regs in standard order
001-323  365                PUSH PSW        for inactive task
001-324  305                PUSH B
001-325  325                PUSH D
001-326  041                LXI H,          Get SP value
001-327  000                    0
001-330  000
001-331  071                DAD SP
001-332  353                XCHG            Free H
001-333  052                LHLD            Get pointer to current TCB (running)
001-334  070                CVTCTC
001-335  001
001-336  001                LXI B,          to SP field in TCB
001-337  006                    TCBSTK + 2  for push
001-340  000                    -TCBTCB
001-341  011                DAD B
001-342  371                SPHL
001-343  325                PUSH D          Push SP value into TCB
001-344  303                JMP             To dispatcher to see if posted task was
001-345  035                    DISPATCH    higher priority
001-346  001
001-347  365  SVC12         PUSH PSW        Disabled post-returns to caller immedi-
001-350  257                XRA A           ately. Zero A = no wait on ECB
001-351  064                INR M           Post ECB(= add 1) if was minus, some-
                                            one was waiting for this post
001-352  312                JZ              Now zero means was -1
001-353  365                    WASWAIT
001-354  001
001-355  372                JM              Still negative
001-356  365                    WASWAIT
001-357  001
001-360  062                STA             Set flag that no wait existed
001-361  275                    REDEFL
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001-362  001
001-363  361                POP PSW         Restore register
001-364  311                RET             and back to caller
001-365  345  WASWAIT       PUSH H          Now we have to find TCB waiting for
001-366  305                PUSH B          this ECB and make it ready to resume
001-367  325                PUSH D          Save the remaining registers
001-370  042                SHLD            Save location of ECB posted
001-371  300                      SEMSAV
001-372  001
001-373  057                CMA             Make ACC non-zero
001-374  062                STA             and set did post someone flag
001-375  275                      REDEFL
001-376  001
001-377  041                LXI H,          Get SP value
002-000  000                  0
002-001  000
002-002  071                DAD SP
002-003  042                SHLD            and save it
002-004  273                SPSAV
002-005  001
002-006  052                LHLD            Get TCB chain for search
002-007  066                      CVT1TC
002-010  001
002-011  072                LDA             Get low byte of addr posted
002-012  300                      SEMSAV
002-013  001
002-014  217                MOV C,A         Save in C for tests
002-015  042  LLOOP         SHLD            Save this TCB's location in case this
002-016  276                      CURTCB      is the one posted
002-017  001
002-020  371                SPHL            Set to pop thru TCB
002-021  341                POP H           Get pointer to next TCB
002-022  361                POP PSW         Get dispatchability flags and count
002-023  312                JZ              If dispatchable, not waiting
002-024  015                      LLOOP
002-025  002
002-026  362                JP              If not waiting
002-027  015                LLOOP
002-030  002
002-031  321                POP D           Skip SP in TCB. Waiting TCB. examine
002-032  321                POP D           ECB list PTR
002-033  353                XCHG            Save H, PTR to H for mem access
002-034  107                MOV B,A         List length
002-035  171  TEST1         MOV A,C         Low bytes addr of post
002-036  276                CMP M           Equal low byte of addr in list?
002-037  043                INX H           Point to high byte
002-040  302                JNZ             Not equal
002-041  052                      NEOL
002-042  002
002-043  072                LDA             Get high byte of addr posted
002-044  301                      SEMSAV + 1
002-045  001
002-046  276                CMP M           Equal high byte of addr in list?
002-047  312                JZ              If equal, this task was waiting for the
002-050  063                      TCBHIT      ECB (event) we just posted
002-051  002
002-052  043  NEOL          INX H           Move to next addr in list
002-053  005                DCR B           Have we done all of this list?
002-054  302                JNZ             No, go test this one
002-055  035                      TEST1
002-056  002
002-057  353                XCHG            Yes, put next TCB PTR back in HL
002-060  303                JMP             and go process it
002-061  015                LLOOP
002-062  002
002-063  052  TCBHIT        LHLD            Get addr of ECB posted, to put in
002-064  300                      SEMSAV      (via stack) HL of posted task
002-065  001
002-066  065                DCR M           We will INR all ECB's in list, so prevent
002-067  052                LHLD            twice INR (from above)
002-070  276                      CURTCB
002-071  001
002-072  371                SPHL            Mark TCB as not waiting (and ready)
002-073  301                POP B           Skip link
002-074  301                POP B           Get flag field (in C)
002-075  171                MOV A,C
002-076  346                ANI             Turn off waiting flag (and 1S always
002-077  105                      01000101B   set by PUSH PSW)
002-100  302                JNZ             Are bits still on?
002-101  105                      STNOND      If so, other causes of not ready
002-102  002
002-103  366                ORI             Turn on ready bit
002-104  100                      01000000B
002-105  117  STNOND        MOV C,A         Put updated flags back in TCB
002-106  305                PUSH B
002-107  341                POP H           Skip flags
002-110  341                POP H           Get SP value
002-111  021                LXI D,          Offset to HL in stack
002-112  010                  8
002-113  000
002-114  031                DAD D
002-115  371                SPHL            Point SP into posted task's stack
002-116  052                LHLD            Get semaphor (ECB) location
002-117  300                      SEMSAV
002-120  001
002-121  345                PUSH H          Push into HL save
002-122  052                LHLD            Get ECB list PTR from TCB posted
002-123  276                      CURTCB
002-124  001
002-125  371                SPHL
002-126  341                POP H           Skip other fields
002-127  341                POP H
002-130  341                POP H
002-131  341                POP H           Get pointer
002-132  371                SPHL            Use stack ptr to run thru list
002-133  341  LOOPUW        POP H           Get next ECB pointer
002-134  064                INR M           Restore ECB to before wait value
002-135  005                DCR B           Count list. (B set back at 002-074)
002-136  302                JNZ             Loop thru entire list
002-137  133                      LOOPUW
002-140  002
002-141  052                LHLD            Recover real stack pointer
002-142  273                      SPSAV
002-143  001
002-144  371                SPHL            Stack setup
002-145  321                POP D           Restore regs
002-146  301                POP B
002-147  341                POP H
002-150  361                POP PSW
002-151  311                RET             Return to caller (still disable interrupts)
002-152  076  WAITR         MVI A,          Background task-waits for all interrupts
002-153  377                  255           Mark end of tune
002-154  002                STAX B          Pointed to by BC
002-155  041                LXI H,          Call system wait routine
002-156  256                ECBL            HL points to list of 6 ECBs
002-157  003
002-160  076                MVI A,          ACC gives list length
002-161  006                  6
002-162  315                CALL            Call wait (via std jump vector)
002-163  103                      SVC01       At 100Q + 3-(SVC number)
002-164  000
002-165  175                MOV A,L         HL points to ECB posted, so see if it
002-166  376                CPI             was INECB2 (keyboard terminal in)
002-167  032                      L(INECB2)
002-170  041                LXI H,          Fake look of call with return to WAITR
002-171  152                      WAITR
002-172  002
002-173  345                PUSH H          Put ret addr in stack
002-174  300                RNZ             To WAITR if not INECB2 (clear and
002-175  046                MVI H,          ignore interrupt)
002-176  000                  0             Zero H for later DAD with L value
002-177  072                LDA             Get input character
002-200  031                      DATAIN2
002-201  001
002-202  376                CPI             Space? (Means a rest)
002-203  040                C' '
002-204  312                JZ              Jump to space routine
002-205  303                      SETSP
002-206  002
002-207  330                RC              Ignore control characters (allows free
002-210  376                CPI             CR LF etc) Is it X? (cancel tune)
002-211  130                      C'X'
002-212  302                JNZ             No, continue checking
002-213  221                      NOTX
002-214  002
002-215  001                LXI B,          It is X, so reset to start of tune area
002-216  365                      TUNE1       (play will go to end of old tune before
002-217  002                                  seeing new condition)
002-220  311                RET             Go wait for next command
002-221  376  NOTX          CPI             Is it '#'? (Make previous note sharp)
002-222  043                C'#'
002-223  312                JZ              Yes, go process
002-224  273                      SHARP
002-225  002
002-226  376                CPI             Is it '  ' (Undo last note or rest)?
002-227  134                C' '
002-230  312                JZ              Yes, go back up
002-231  252                      BACK
002-232  002
002-233  376                CPI             Number or letter?
002-234  100                      C'@'
002-235  332                JC              Newscale if a number
002-236  254                      NEWSCALE
002-237  002
002-240  207                ADD A           Double letter for table offset
002-241  157                MOV L,A         Put A in HL
002-242  031                DAD D           Add current octave base address
002-243  042                SHLD            Save result for possible sharp
002-244  310                      LASTN
002-245  002
002-246  176  DONO          MOV A,M         Get note value from table
002-247  002  DONO2         STAX B          Put note in end of tune
002-250  003                INX B           Advance end pointer
002-251  311                RET             Go wait for next command
002-252  013  BACK          DCX B           Back up one note
002-253  311                RET             and wait for next command
002-254  346  NEWSCAL       ANI A,          Isolate 0 to 3 scale number
002-255  003                  3
002-256  157                MOV L,A         Multiply by 14
002-257  207                ADD A
002-260  205                ADD L
002-261  207                ADD A
002-262  205                ADD L
002-263  207                ADD A
002-264  157                MOV L,A         Add to basic table location
002-265  021                LXI D,          Base table location
002-266  052                TABORG-14-
                            2*C'A'
002-267  003
002-270  031                DAD D           HL = PTR to 1st note in selected octave
002-271  353                XCHG            Table when 2*C'A' added, put into DE
002-272  311                RET             Go wait for next command
002-273  052  SHARP         LHLD            Get location of last note entered
002-274  310                      LASTN
002-275  002
002-276  043                INX H           Point to sharp entry after note
002-277  013                DCX B           Back to rewrite last note in tune
002-300  303                JMP             Go pick up note
002-301  246                      DONO
002-302  002
002-303  076  SETSP         MVI A,          Silence code
002-304  002                  2
002-305  303                JMP             Go store note (rest) in tune
002-306  247                      DONO2
002-307  002
002-310  332  LASTN         DCA             Pointer to last note in table
002-311  003
002-320  124                DCA TABORG      Base value for 3rd octave (DE)
002-321  003                + 28-2*C'A'
002-322  123                DCA             Pointer to end of melody (BC)
002-323  003
002-324  207                DSB             Suspended flags
002-325  006                DCB 6           Size of ECB list (ACC)
002-326  256                DCA ECBL        Pointer to ECB list (HL)
002-327  003
002-330  165                DCA WAITR       Return PTR (to after call wait)
002-331  002                + 13Q
003-256  021  ECBL          DCA             List of ECBs for wait
003-257  001                      INECB0
003-260  022                DCA
003-261  001                      OUTECB0
003-262  023                DCA
003-263  001                      STATEC0
003-264  032                DCA
003-265  001                      INECB2
003-266  033                DCA
003-267  001                      OUTECB2
003-270  034                DCA
003-271  001                      STATEC2
003-272  146  TABORG        DCB 102         Note look up table. First octave. A
003-273  140                DCB 96          A#      Absolute scale depends on
003-274  132                DCB 90          B       CPU and memory speed, but
003-275  132                DCB 90          (B#)    notes are relatively correct.
003-276  252                DCB 170         C
003-277  240                DCB 160         C#
003-300  230                DCB 152         D
003-301  220                DCB 144         D#
003-302  211                DCB 137         E
003-303  211                DCB 137         (E#)
003-304  200                DCB 128         F
003-305  172                DCB 122         F#
003-306  162                DCB 116         G
```

```
003-307  154          DCB 108   G#
003-310  063          DCB 51    A     Second octave
003-311  060          DCB 48    A#
003-312  055          DCB 45    B
003-313  055          DCB 45    (B#)
003-314  125          DCB 85    C
003-315  120          DCB 80    C#
003-316  114          DCB 76    D
003-317  110          DCB 72    D#
003-320  105          DCB 69    E
003-321  105          DCB 69    (E#)
003-322  100          DCB 64    F
003-323  075          DCB 61    F#
003-324  072          DCB 58    G
003-325  066          DCB 54    G#
003-326  031          DCB 25    A     Third octave
003-327  030          DCB 24    A#
003-330  026          DCB 22    B
003-331  026          DCB 22    (B#)
003-332  053          DCB 43    C
003-333  050          DCB 40    C#
003-334  046          DCB 38    D
003-335  044          DCB 36    D#
003-336  042          DCB 34    E
003-337  042          DCB 34    (E#)
003-340  040          DCB 32    F
003-341  036          DCB 30    F#
003-342  034          DCB 28    G
003-343  033          DCB 27    G#
002-365  034  TUNE1   DCB 3G    Daisy. 94 bytes. DCN = Define Con-
                                stant.Note
002-366  034          DCN G     Note ellipses of octave number when
002-367  034          DCN G     no change. This tune was entered with
002-370  042          DCN E     the system running, by typing the con-
002-371  042          DCN E     tents of the mnemonic column, om-
                                mitting 'DCN's.
002-372  042          DCN E
002-373  053          DCN C
002-374  053          DCN C
002-375  053          DCN C
002-376  072          DCN 2G
002-377  072          DCN G
003-000  072          DCN G
003-001  063          DCN A
003-002  055          DCN 2B
003-003  053          DCN 3C
003-004  063          DCN 2A
003-005  063          DCN A
003-006  053          DCN 3C
003-007  072          DCN 2G
003-010  072          DCN G
003-011  072          DCN G
003-012  072          DCN G
003-013  072          DCN G
003-014  072          DCN G
003-015  046          DCN 3D
003-016  046          DCN D
003-017  046          DCN D
003-020  034          DCN G
003-021  034          DCN G
003-022  034          DCN G
003-023  042          DCN E
003-024  042          DCN E
003-025  042          DCN E
003-026  053          DCN C
003-027  053          DCN C
003-030  053          DCN C
003-031  063          DCN 2A
003-032  055          DCN B
003-033  046          DCN 3D
003-034  046          DCN D
003-035  042          DCN E
003-036  046          DCN 3D
003-037  046          DCN D
003-040  046          DCN D
003-041  046          DCN D
003-042  046          DCN D
003-043  042          DCN E
003-044  040          DCN F
003-045  042          DCN E
003-046  046          DCN D
003-047  034          DCN G
003-050  034          DCN G
003-051  042          DCN E
003-052  046          DCN D
003-053  053          DCN C
003-054  053          DCN C
003-055  053          DCN C
003-056  053          DCN C
003-057  046          DCN D
003-060  042          DCN E
003-061  042          DCN E
003-062  053          DCN C
003-063  063          DCN 2A
003-064  063          DCN A
003-065  053          DCN 3C
003-066  063          DCN 2A
003-067  072          DCN G
003-070  072          DCN G
003-071  072          DCN G
003-072  072          DCN 2G
003-073  072          DCN G
003-074  053          DCN 3C
003-075  053          DCN C
003-076  042          DCN E
003-077  046          DCN D
003-100  046          DCN D
003-101  072          DCN 2G
003-102  053          DCN 3C
003-103  053          DCN C
003-104  042          DCN E
003-105  046          DCN D
003-106  042          DCN E
003-107  040          DCN F
003-110  034          DCN G
003-111  042          DCN E
003-112  053          DCN C
003-113  046          DCN D
003-114  046          DCN D
003-115  072          DCN 2G
003-116  053          DCN 3C
003-117  053          DCN C
003-120  053          DCN C
003-121  053          DCN C
003-122  002          DCN REST
003-123  377          DCB 255   End of tune marker.
```

CONVBASE: Getting Down to Bases

by Irwin Doliner

INTRODUCTION

Anyone who becomes intimately involved with computers quickly learns that he must become familiar with some strange and exotic number systems. They will be systems in which 1 + = 10 or 4 + 4 = 10 or 8 + 8 = 10 with names like Binary, Octal and Hexadecimal.

Of course, once these systems are learned they no longer seem strange or exotic but perfectly natural. With sufficient practice you may even achieve the same facility with these number systems as you now have with the ordinary decimal system. The program (CONVBASE) which accompanies this article was designed to provide that practice.

THE FOUR SYSTEMS

If one is to become proficient with the various number systems it is first necessary to understand them. Since the construction of the Decimal, Binary, Octal and Hexadecimal systems are essentially the same Decimal system, the principle will be analyzed and sufficiently generalized to represent all base number systems.

First the distinction between numbers and numerals must be understood. This definition may make a mathematics purist shiver but in general numbers are synonymous with quantities and numerals are symbols used to represent numbers. For example, if there are ten people in a room the number of people is fixed and is not subject to definition. If you represented this number with the numerals 10 there would be no confusion since the Decimal system is implied when no other base is indicated. However, with suitable definitions, ten may also be represented by 'X', 'A' or any other symbol you may choose.

There are two essential properties of the Decimal (or any base) number system. They are:

- The number of symbols (ten in Decimal) used to represent numbers (the ten Decimal symbols are 0, 1, 2, 3, 4, 5, 6, 7, 8, 9).
- The place values (values assigned to each position which can hold a symbol—what the school children learn as 'units,' 'tens,' 'hundreds,' and upwards).

The symbols are assigned the values and the names of the numbers which they ordinarily represent. But it is the concept of place value that gives the base number systems power and flexibility which systems such as Roman numerals could never have. The symbol 9 is assigned a value of nine and it contributes nine to the number 49 but ninety to the number 94. In each case the value contributed is the product of the symbol value with the place value. The place values in the Decimal system, as everyone knows are (from right to left):

etc. . . . 1000 100 10 1

Which may be written another way as:

etc. . . . 10^3 10^2 10^1 10^0

The number represented is the sum of the products of the numeral assigned values and the place values. Then the number is represented by 347 (Decimal assumed if no other base is indicated) is

$(3 \times 10^2) + (4 \times 10^1) + (7 \times 10^0)$.

If we let B = 10, $S_0 = 7$, $S_1 = 4$ and $S_2 = 3$ then this number may be written

$(S_2 \times B^2) + (S_1 \times B^1) + (S_0 \times B^0)$.

Just as the base 10 system used ten symbols with values 0, 1, . . ., 9 and place values of the base (10), so any other base number system is similarly constructed. Hence if we wish to construct a base B system (where B is some integer greater than one) this system would have B symbols with values 0, 1, . . ., B-1 and place values would be powers of B as follows:

etc. . . . B^2 B^1 B^0

and the number represented by $S_2S_1S_0$ would be

$(_2 \times B^2) + (S_1 \times B^1) + (S_0 \times B^0)$.

The following table gives the elements in constructing the more popular number systems:

NAME	BASE	SYMBOLS
Decimal	10	0,1,2,3,4,5,6,7,8,9
Binary	2	0,1
Octal	8	0,1,2,3,4,5,6,7
Hexadecimal	16	0,1,2,3,4,5,6,7,8,9,A,B,C,D,E,F

The following table shows how one would count in these bases.

DECIMAL	BINARY	OCTAL	HEXADECIMAL
0	0	0	0
1	1	1	1
2	10	2	2
3	11	3	3
4	100	4	4
5	101	5	5
6	110	6	6
7	111	7	7
8	1000	10	8
9	1001	11	9
10	1010	12	A
11	1011	13	B
12	1100	14	C
13	1101	15	D
14	1110	16	E
15	1111	17	F
16	10000	20	10

Now you may say "Decimal is the standard number system and I know that computers 'think' in Binary. But of what earthly value are Octal and Hexadecimal? They just seem to add to the confusion." One important value of the Octal and Hexadecimal systems is that they provide a shorthand method of writing Binary, in much the same way that an engineer will write 10^{64} rather than 1 followed by 64 zeros.

If a number is represented in Binary and you wish to represent in Octal, first divide the Binary into groups of three from right to left and convert each group according to the foregoing table. For example:

Binary:	11001011010101111					
groups of 3:	11	001	011	010	101	111
Octal:	3	1	3	2	5	7

For Binary to Hexadecimal divide into groups of four and convert from the table. For example:

Binary:	11001011010101111					
groups of 4:	1	1001	0110	1010	1111	
Hexadecimal:	1	9	6	A	F	

Hence $11001011010101111_2 = 313257_8 = 196AF_{16}$.* It is easy to see that Octal and Hexadecimal are less cumbersome than Binary for representing large numbers, without losing Binary information.

"All of this is fine," you say, "but, for a specific application, how would I convert 8936 in Decimal to Octal?" That is a good question! There are many possible answers. One method is to set out the place value for the base to which you are converting as follows:

POSITION	5	4	3	2	1	0
PLACE VALUE	8^5	8^4	8^3	8^2	8^1	8^0
DECIMAL EQUIVALENT:	32768	4096	512	64	8	1

Next select the highest numbered position which does not exceed the number (8936) to be converted. For this example that would be position 4. Assign to this position the largest digit so that its product with the place value does not exceed the number to be converted. For this example a 2 would be assigned to position 4. Subtract this product from the number (i.e. $8936 - 2 \times 4096 = 744$). We now have:

POSITION	5	4	3	2	1	0
OCTAL DIGIT		2				

and the number to be converted is now 744. Continuing as above we next place a 1 in position 3 leaving 232 to be converted. After five such iterations we should have:

POSITION	5	4	3	2	1	0
OCTAL DIGIT		2	1	3	5	0.

Hence $21350_8 = 8936$.

Another method uses repeated division by the base and the remainder of each division is the next higher digit. The division-remainder method applied to the above example is as follows:

DIVISION		OCTAL
8936/8 = 1117	REM = 0	0
1117/8 = 139	REM = 5	50
139/8 = 17	REM = 3	350
17/8 = 2	REM = 1	1350
2/8 = 0	REM = 2	21350.

Both methods are general and may be applied for conversion from Decimal to any base. The second method has the advantage of not having to calculate place values and is the one used in the program CONVBASE (lines 1000-1070).

SUMMARY

Decimal, Binary, Octal and Hexadecimal are the most commonly used bases. You will probably be interested in gaining the most proficiency in converting between any pair of them. CONVBASE may be used to help develop and test this proficiency. But you may also wish to test your understanding of general number bases by converting from base 3 to base 5 or base 7 to base 11. In general, CONVBASE may be instructed to generate numbers and represent them in any base form 2 to 16 and test your ability to convert them to any other base in the same range.

```
RUN
NEED INSTRUCTIONS? Y
BASECONV TESTS YOUR SKILL IN CONVERTING FROM ONE NUMBER BASE
TO ANOTHER.  YOU SPECIFY THE BASE IN WHICH THE COMPUTER
SHOULD GIVE YOU NUMBERS AND THE BASE TO WHICH YOU WISH TO
CONVERT THEM.  YOU ALSO SPECIFY THE RANGE OF VALUES YOU ARE
INTERESTED IN (IN THE BASE 10) AND HOW MANY NUMBERS IN THE
```

*The number base is denoted by a subscript (e.g. 2, 8, 16). If no subscript is used the base is assumed to be 10.

```
TEST.  FOR EXAMPLE--IF YOU WISH TO CONVERT FROM DECIMAL TO
BINARY,12 NUMBERS IN THE RANGE OF 1 TO 32--THE COMPUTER WILL
TYPE:
FR,TO,LO,HI,#?
YOU MUST TYPE AFTER THE QUESTION MARK (?)
10,2,1,32,12


GOOD LUCK !!!


FR,TO,LO,HI,#? 2,8,1,32,5


(BASE 2 )=101 (BASE 8 )=? 5
** CORRECT **


(BASE 2 )=1000 (BASE 8 )=? 8
!! 8 IS NOT VALID IN BASE 8 ? 10
** CORRECT **


(BASE 2 )=111 (BASE 8 )=? 6
!! TOO LOW? 7
** CORRECT **


(BASE 2 )=11101 (BASE 8 )=? 71
!! TOO HIGH? 34
!! TOO LOW? 36
!! TOO HIGH - THE CORRECT ANSWER IS 35


(BASE 2 )=11100 (BASE 8 )=? 34
** CORRECT **

 4  CORRECT OUT OF  9  ANSWERS: SCORE= 44.4444 %
AGAIN? Y
FR,TO,LO,HI,#? 2,16,8,32,5

(BASE 2 )=10110 (BASE 16 )=? 26
!! TOO HIGH? 16
** CORRECT **


(BASE 2 )=10001 (BASE 16 )=? 11
** CORRECT **


(BASE 2 )=1000 (BASE 16 )=? 8
** CORRECT **


(BASE 2 )=11101 (BASE 16 )=? 35
!! TOO HIGH? 1C
!! TOO LOW? 1E
!! TOO HIGH - THE CORRECT ANSWER IS 1D


(BASE 2 )=11011 (BASE 16 )=? 1B
** CORRECT **

 4  CORRECT OUT OF  8  ANSWERS: SCORE= 50 %
AGAIN? Y
FR,TO,LO,HI,#? 16,8,32,64,5


(BASE 16 )=26 (BASE 8 )=? 46
** CORRECT **


(BASE 16 )=34 (BASE 8 )=? 64
** CORRECT **


(BASE 16 )=2C (BASE 8 )=? 55
!! TOO HIGH? 54
** CORRECT **


(BASE 16 )=27 (BASE 8 )=? 47
** CORRECT **


(BASE 16 )=38 (BASE 8 )=? 70
** CORRECT **

 5  CORRECT OUT OF  6  ANSWERS: SCORE= 83.3333 %
AGAIN? Y
FR,TO,LO,HI,#? 3,7,1,14,5


(BASE 3 )=11 (BASE 7 )=? 4
** CORRECT **


(BASE 3 )=112 (BASE 7 )=? 20
** CORRECT **


(BASE 3 )=21 (BASE 7 )=? 10
** CORRECT **


(BASE 3 )=1 (BASE 7 )=? I
** CORRECT **


(BASE 3 )=111 (BASE 7 )=? 16
** CORRECT **

 5  CORRECT OUT OF  5  ANSWERS: SCORE= 100 %
AGAIN? N

OK
0 REM       PGM:       BASECONV     2/15/76


1 REM       WRITTEN BY:IRWIN DOLINER (INTERACTIVE DATA SYSTEMS)
2 REM       ADDRESS:   P. O. BOX 290
3 REM                  OWINGS MILLS, MARYLAND 21117
```

```
4 DIM C$(15)
5 FOR I=0 TO 15:READ C$(I):NEXT I
6 DATA 0,1,2,3,4,5,6,7,8,9,A,B,C,D,E,F
7 INPUT"NEED INSTRUCTIONS";A$
8 IF LEFT$(A$,1)="N" GOTO 93
9 PRINT:PRINT:PRINT
10 REM >>>>>>>>>>>>>>>>> I N S T R U C T I O N S <<<<<<<<<<<<<<<<<
15 PRINT"BASECONV TESTS YOUR SKILL IN CONVERTING FROM ONE NUMBER BASE"
20 PRINT"TO ANOTHER.  YOU SPECIFY THE BASE IN WHICH THE COMPUTER"
30 PRINT"SHOULD GIVE YOU NUMBERS AND THE BASE TO WHICH YOU WISH TO"
40 PRINT"CONVERT THEM.  YOU ALSO SPECIFY THE RANGE OF VALUES YOU ARE"
50 PRINT"INTERESTED IN (IN THE BASE 10) AND HOW MANY NUMBERS IN THE "
60 PRINT"TEST.  FOR EXAMPLE--IF YOU WISH TO CONVERT FROM DECIMAL TO"
70 PRINT"BINARY, 12 NUMBERS IN THE RANGE OF 1 TO 32--THE COMPUTER WILL"
75 PRINT"TYPE:"
80 PRINT"FR,TO,LO,HI,#?"
91 PRINT"YOU MUST TYPE AFTER THE QUESTION MARK (?)"
92 PRINT"10,2,1,32,12"
93 PRINT:PRINT:PRINT"GOOD LUCK !!!"
94 PRINT:PRINT:PRINT
95 REM >>>>>>>>>>>>>>> G E T   P A R A M E T E R S <<<<<<<<<<<<<<<
100 PRINT"FR,TO,LO,HI,#";
101 INPUT B1,B2,L0,H1,R
110 REM >>> C H E C K   T H A T   B A S E S   A R E   V A L I D <<<
111 IF B1<17 GOTO 114
112 PRINT "ONLY BASES FROM 2 TO 16"
113 GOTO 100
114 IF B1<2 GOTO 112
115 IF B2>16 GOTO 112
116 IF B2<2 GOTO 112
117 IF B1<>B2 GOTO 120
118 PRINT"THAT WON'T BE MUCH OF A TEST!!!!!"
119 GOTO 100
120 REM >>>>>>>>> I N I T I A L I Z E   C O U N T E R S <<<<<<<<<
125 P=0
130 Q=0
140 C=0
150 M=H1-L0+1
160 IF P>=R THEN 440
170 P=P+1
175 REM >>>>>>>>>>>> P I C K   T E S T   N U M B E R <<<<<<<<<<<<
180 N=L0+INT(M*RND(2))
210 B=B1
220 GOSUB 1000
230 Q$=P$
240 B=B2
250 GOSUB 1000
260 L=0
263 PRINT
266 PRINT
270 PRINT"(BASE";B1;")=";Q$;" (BASE";B2;")=";
290 IF L<3 THEN 320
300 PRINT" - THE CORRECT ANSWER IS ";P$
310 GOTO 160
320 L=L+1
330 Q=Q+1
335 INPUT T$
336 REM >>>>>>>>>>>>>>>> C H E C K   A N S W E R <<<<<<<<<<<<<<<<
340 X$=P$
341 IF LEN(T$)>=LEN(X$) GOTO 346
342 T$="0"+T$
343 GOTO341
346 IF LEN(T$)=LEN(X$) GOTO 350
347 X$="0"+X$
348 GOTO 346
350 FOR I=1 TO LEN(T$)
351 FOR J=0 TO B2-1
352 IF MID$(T$,I,1)=C$(J) GOTO 356
353 NEXT J
354 PRINT "!! ";MID$(T$,I,1);" IS NOT VALID IN BASE";B2;
355 GOTO 290
356 NEXT I
359 IF T$<X$ GOTO 400
360 IF T$>X$ GOTO 420
370 C=C+1
380 PRINT"** CORRECT **"
390 GOTO 160
400 PRINT"!! TOO LOW";
410 GOTO 290
420 PRINT"!! TOO HIGH";
430 GOTO 290
440 PRINT
450 PRINT C;" CORRECT OUT OF ";Q;" ANSWERS: SCORE=";100*C/Q;"%"
460 PRINT"AGAIN";
470 INPUT A$
480 IF LEFT$(A$,1)="Y" GOTO 100
500 GOTO 1100
990 REM >>> C O N V E R T   T O   R E Q U I R E D   B A S E <<<
1000 P$=""
1010 I=0
1020 J=N
1030 K=INT(J/B)
1040 I=J-B*K
1050 P$=C$(I)+P$
1060 J=K
1070 IF J>0 THEN 1030
1080 RETURN
1100 END
19000 <><><><><><><><><><><><><><><><><><><><><><><><><><><><><><><><><><>
20000 VARIABLES AND THEIR DEFINITIONS
20010 -------------------------------
20020 A$ = OPERATOR'S ANSWER TO YES/NO QUESTIONS
20030 B  = DUMMY VARIABLE FOR BASE
20040 B1 = THE BASE FROM WHICH YOU ARE CONVERTING
20050 B2 = THE BASE TO WHICH YOU ARE CONVERTING
20060 C  = THE NUMBER OF CORRECT ANSWERS
20070 H1 = THE HIGH VALUE OF THE VALID RANGE
20080 L  = THE NUMBER OF ANSWERS GIVEN TO CURRENT PROBLEM
20090 L0 = THE LOW VALUE OF THE VALID RANGE
20100 M  = THE NUMBER OF VALUES IN THE VALID RANGE
20110 N  = THE CURRENT TEST NUMBER
20120 P  = THE NUMBER OF PROBLEMS GIVEN SO FAR
20130 P$ = THE STRING REPRESENTATION OF N IN BASE 'B1'
20140 Q  = THE TOTAL QUANTITY OF ANSWERS GIVEN
20150 Q$ = THE STRING REPRESENTATION OF N IN BASE 'B2'
20160 R  = THE NUMBER OF PROBLEMS REQUESTED
20170 T$ = THE ANSWER GIVEN BY OPERATOR WITH POSSIBLE '0'
20175      PADDING TO MAKE LEN(T$)=LEN(X$)
20180 X$ = EQUIVALENT TO P$ WITH POSSIBLE '0' PADDING
20190      TO MAKE LEN(X$) = LEN(T$)
21000 <><><><><><><><><><><><><><><><><><><><><><><><><><><><><><><><><><>

OK
```

Number Base Conversion Program —MWNBCP

by Mark Winkler

INTRODUCTION

This program accepts decimal, binary, octal, split-octal and hexadecimal numbers and converts them into any one of the other bases. Binary, split-octal, and hexadecimal address locations can easily be converted to decimal or vice versa for Peek, Poke and User operations in BASIC. The program was written in 8K 3.1 MITS BASIC (8080).

PROGRAM DESCRIPTION

All numbers entered are first converted to decimal. The routine at 920 to 1070 is directly used for binary and octal numbers. The routine first determines the number of places in the entered number. It does this by dividing by 1, 10, 100, 1000, etc. until a number less than one is obtained. The number calculated (E) is the power to which (Z) is raised. (Z) is equal to the base value. (Z) raised to (E) times the high order digit plus (Z) raised to (E) — 1 times the next digit, etc. is equal to the decimal number.

Split-octal and hexadecimal numbers must be treated somewhat differently. The hexadecimal conversion is done on lines 1400 to 1500. The routine inputs the number as a string variable. It then determines the number of places of the inputted number. Any letters entered are converted to their equivalent numbers. The routine then computes the decimal number the same way as did the 920-1070 routine.

A split-octal number is really two octal numbers. The three low-order digits make up one number and the three high-order digits make up the other. The three high-order digits are converted to decimal by the 920 to 1070 routine and then the result is multiplied by 256. The low-order bits are converted to decimal and then added to the result obtained from the high-order digits. The routine 1260 to 1350 performs the split-octal conversion.

The decimal numbers obtained from the other routines are converted to other bases by use of the routine 800 to 912. The decimal number (A) to be converted is divided by the base value (Z) repeatedly until a zero is obtained. The first remainder is the least significant digit and the last remainder is the most significant digit.

EXAMPLE********** 30 base 10 to binary

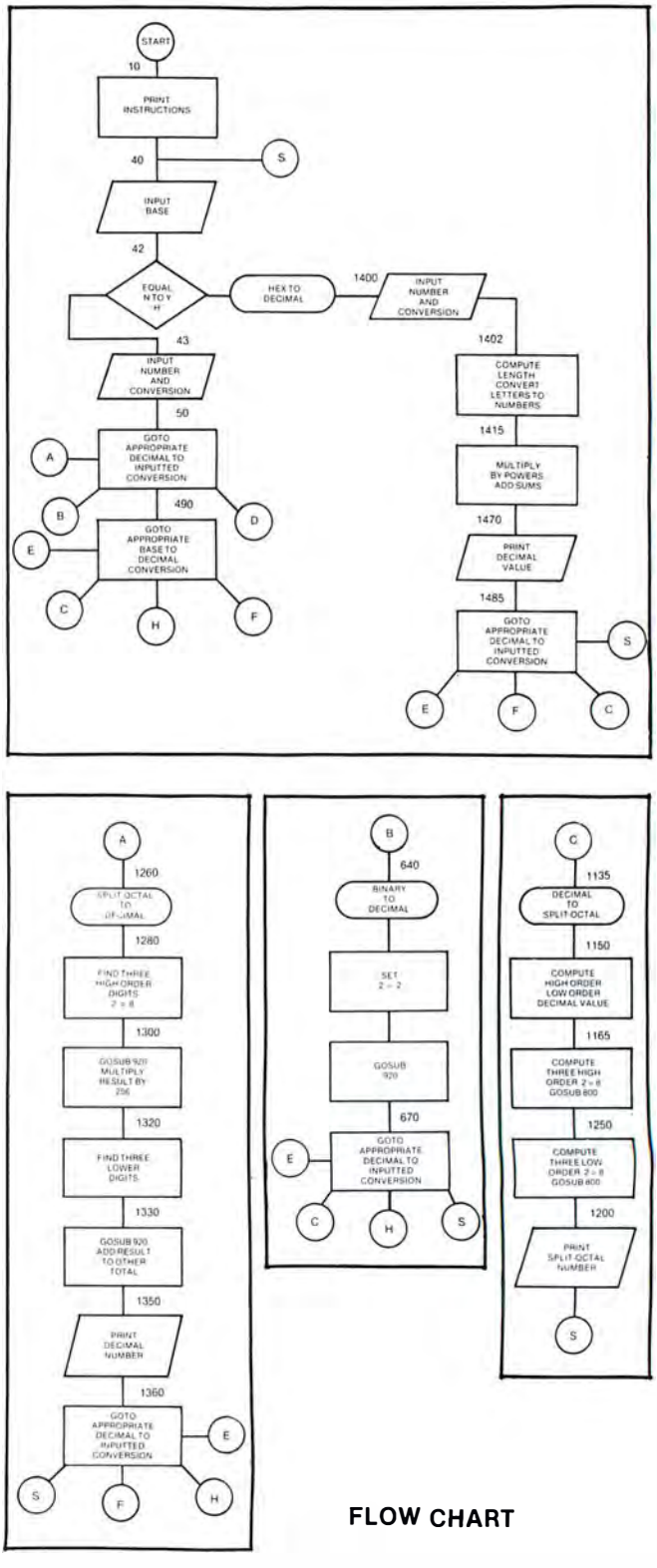
30 divided by 2		
15	0	(Lsd)
7	1	
3	1	
1	1	
0	1	(Msd)

The routine converts binary and octal numbers directly.

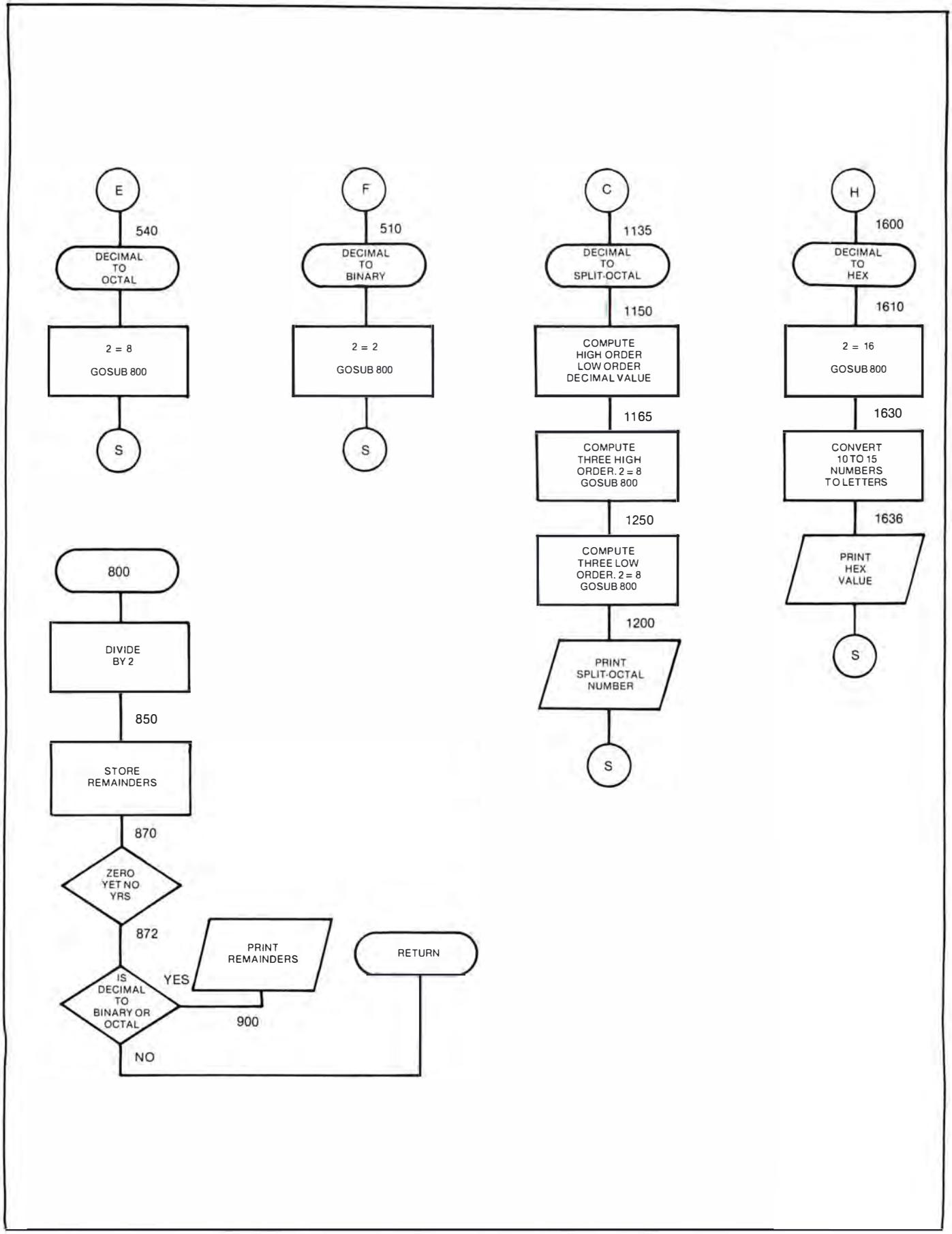
The decimal to split-octal 1135 to 1250 must first divide the number by 256. The whole number obtained is then converted to octal. This number makes up the three high-order digits. The three low digits are the octal equivalent of the decimal remainder.

The decimal to hexadecimal routine 1600 to 1661 converts the remainders above ten to the appropriate letters.

I hope this program saves you as much time as it did me.



FLOW CHART


E
540
DECIMAL TO OCTAL
2 = 8
GOSUB 800
S
F
510
DECIMAL TO BINARY
2 = 2
GOSUB 800
S
C
1135
DECIMAL TO SPLIT-OCTAL
1150
COMPUTE HIGH ORDER LOW ORDER DECIMAL VALUE
1165
COMPUTE THREE HIGH ORDER. 2 = 8 GOSUB 800
1250
COMPUTE THREE LOW ORDER. 2 = 8 GOSUB 800
1200
PRINT SPLIT-OCTAL NUMBER
S
H
1600
DECIMAL TO HEX
1610
2 = 16
GOSUB 800
1630
CONVERT 10 TO 15 NUMBERS TO LETTERS
1636
PRINT HEX VALUE
S
800
DIVIDE BY 2
850
STORE REMAINDERS
870
ZERO YET NO YRS
872
IS DECIMAL TO BINARY OR OCTAL
YES
PRINT REMAINDERS
900
NO
RETURN

```
10 PRINT"I CONVERT NUMBERS IN DECIMAL,OCTAL,OCTAL-SPLIT,HEX,AND BINARY"
20 PRINT"TYPE IN BASE,NUMBER,AND CONVERSION"
30 PRINT "DECIMAL=D      OCTAL=O    BINARY=B"
31 PRINT"OCTAL-SPLIT=OS     HEXIDECIMAL=H  "
35 PRINT"I CAN ONLY INPUT TO 7 PLACES"
36 DIM B(20)
37 PRINT"WHEN DONE HIT RETURN"
40 INPUT "BASE";Z$
42 IF Z$="H"THEN1400
43 INPUT "NUMBER AND CONVERSION";A,Y$
50 IF Z$="OS"THEN 1260
60 IF Z$="D"THEN 490
70 IF Z$="O"THEN580
80 GOTO 640
490 IF Y$="O"THEN 540
495 IF Y$="H"THEN 1600
500 IF Y$="OS"THEN1135
510 Z=2
520 Y$="BINARY ="
530 GOSUB 800
535 GOTO 40
540 Z=8
550 Y$="OCTAL ="
560 GOSUB 800
565 GOTO 40
580 Z=8
590 IF Y$="D"THEN 620
595 IF Y$="OS"THENGOSUB920:A=G:GOTO1135
596 IF Y$="H"THEN GOSUB920:A=G:GOTO1600
600 GOSUB 920
610 A=G:GOTO510
620 GOSUB 920
630 GOTO40
640 Z=2
670 IF Y$="D"THEN700
675 IF Y$="OS"THENGOSUB920:A=G:GOTO1135
676 IF Y$="H"THENGOSUB920:A=G:GOTO1600
680 GOSUB 920
690 A=G: GOTO 540
700 GOSUB 920
710 GOTO 40
800 N=0
810 N=N+1
830 B=INT(A/Z)
840 C=A-(B*Z)
850 B(N)=INT(C+.5)
860 A=B
870 IF B>0 THEN 810
872 IF Y$="H"THEN 912
875 IF Y$="OS"THEN912
880 PRINT Y$;
885 GOTO900
890 N=N-1
895 IF N=0 THEN 911
900 PRINT B(N);
910 GOTO890
911 PRINT
912 RETURN
920 C=1:E=(-1)
925 G=0
930 B=A/C
935 E=E+1
940 IF B<Z THEN 970
950 C=C*10
960 GOTO930
970 D=INT(A/C)
980 H=(Z↑E)*D
1000 D=D*C
1010 A=A-D
1020 G=G+H
1025 C=C/10
1040 E=E-1
1050 IF E=>0 THEN 970
1055 IF Z$="OS"THEN1070
1060 PRINT"DECIMAL = ";G
1070 RETURN
1135 PRINT "OCTAL SPLIT=";
1140 B(3)=0:B(2)=0:B(1)=0
1150 B=INT(A/256)
1160 C1=A-(B*256)
1165 X=0
1170 A=B
1180 Z=8
1190 GOSUB 800
1200 N=3
1210 PRINT B(N);
1220 N=N-1
1230 IF N>0 THEN 1210
1240 X=X+1
1245 IF X>1 THEN PRINT:GOTO40
1250 A=C1:B(3)=0:B(2)=0:B(1)=0:GOTO1180
1260 PRINT"DECIMAL=";
1270 C=1000:Z=8
1280 B=INT(A/C)
1290 C1=A-(B*C)
1294 A=B
1300 GOSUB 920
1310 G1=G*256
1320 A=C1
1330 GOSUB 920
1340 G=G+G1
1350 PRINT G
1355 A=G
1360 IF Y$="B"THEN 510
1362 IF Y$="H"THEN1600
1364 IF Y$="O"THEN540
1366 GOTO 40
1400 INPUT"NUMBER AND CONVERSION";X$,Y$
1401 HL=0
1402 G=0
1405 HJ=LEN(X$)
1410 FORI=1TOHJ
1415 XX$=MID$(X$,I,1)
1420 H=ASC(XX$)
1425 HL=HJ-I
1430 IF H=<57THEN1445
1435 B(I)=(H-55)*(16↑HL)
1440 GOTO 1450
1445 B(I)=(H-48)*(16↑HL)
1450 NEXT I
1455 FORI=1TOHJ
1460 G=G+B(I)
1465 NEXT I
1470 PRINT"DECIMAL="G
1480 A=INT(G+.5)
1485 IFY$="O"THEN540
1490 IF Y$="B"THEN 510
1495 IF Y$="OS"THEN 1135
1500 GOTO 40
1600 Z=16
1601 PRINT"HEXIDECIMAL=";
1610 GOSUB 800
1611 GOTO 1630
1615 N=N-1
1625 IFN=0THEN1660
1630 IF B(N)=>10THEN1650
1635 A1=B(N)+48
1636 PRINT CHR$(A1);
1640 GOTO1615
1650 A1=B(N)+55
1655 GOTO 1636
1660 PRINT
1661 GOTO 40
O
```

BLOCKADE

by Kenneth Berkun

INTRODUCTION

Get out the beer and pretzels, kick back and take it easy. Now you can have your very own video game - just like the ones in the real world. BLOCKADE is a computerized version of the Atari coin operated game. It is written for the 8080 computer in PL/M! This game acts enough like the real thing to impress your friends, influence your neighbors, and make you forget about those system bugs with which you've been hassling. First I will describe the game and how to play it, then the hardware it takes to run it, and finally the program itself and how it works.

DESCRIPTION

BLOCKADE is played by two people. On the screen you see two lines of blinking markers growing in length. The players control the direction of growth. The object is to trap the other person. Sounds sweet, and it's a way to take care of your aggressive tendencies. You can tell the advancing column to turn right, left, up or down. But watch it! If you do a complete 180 degree reversal (i.e. you're going down and you tell it to go up) then you've trapped yourself! If you hit any of the walls then you also lose. But on the other hand, if you force your opponent to do any of those things then you've won!

It's easy to panic and flip the wrong switch and do yourself in, which makes this a great game for speed, accuracy, daring, and skill. You need a good sense of timing since the length automatically increments by one every one-quarter or so seconds. It is possible for both people to collide which counts as a tie.

At the end of each game the score is displayed for a few seconds, then a new game starts. After one person wins ten games the match is over and the scores are reset to zero.

One of the pleasures obtainable from this game is the ability to draw interesting figures and patterns on the screen. It is possible to freeze these for prolonged viewing by hitting the stop switch on your computer. With two people working together, rather than opposed, it is possible to create some truly pleasing graphics. Of course this too will take practice! Another challenge is to play both sides yourself! Merely avoiding self-destruct is quite a trick, you have to be quick on the hand-eye coordination and good at doing at least two things at once.

One final warning: this game can be very addictive. People who have in the past sunk untold numbers of quarters in Pong games, pinballs and other such amusements must watch out! It's a great demo for your friends but don't fall victim to the scourge of the screen!

HARDWARE

The game was designed to run on a weird sort of minimal system. The only input devices are the sense switches so no keyboard is required. The output device is a Processor Technology VDM 1. Any sort of memory display CRT device should work, as long as the memory is in the right spot. Thus two pieces of hardware are needed. 1. 8080 Microcomputer (originally an Imsai 8080), 2. Video Terminal (not line by line, but one that uses DMA).

That's almost all there is from the hardware point of view. I shall discuss hardware some more when I talk about the program, such as the location in memory of the video board and how the sense switches work.

PL/M SOFTWARE

The program comes in two versions, the compiled machine language code and the symbolic PL/M code. I will not be much concerned with the machine language here, other than how to load and run it. The interesting part is the symbolic code.

PL/M is a high level language for the 8080 and 8008 microprocessors. It is a subset of PL/1, and an Algol-like language. In some ways it is very powerful, while it is sadly lacking in others. It has a very useful block-structure with IF-THEN-ELSE constructs and DO-END constructs. If you can read or program in Algol you can understand PL/M. However, there are a few annoying differences, at least to me since I am an Algol freak. For instance the equal sign in a replacement statement in Algol is := and in PL/M it is just =. There are no BEGINS just ENDS, and so on. These are all minor. More importantly there is no floating point arithmetic at all. The largest number is 65K and the smallest is −65K. I have been impressed with what I have been able to accomplish within this and other limitations.

Relative addressing is allowed by what is called the BASED attribute. This allows a variable to represent the address of another variable. Also strings are handled very easily (mostly due to the BASED variables). The I/O is very primitive, you just specify which port and either receive a byte, or send one, period. But it is easy to construct your own procedures using these primitives. That's enough about the language to allow you to follow the program since the point of this article is not PL/M, but the game BLOCKADE.

BLOCKADE PROGRAM AND HOW IT WORKS

The program has much internal documentation and is easy to follow by looking at and consulting the flow charts. Basically it goes as follows: Clear the screen, initialize the variables, read the sense switches (input port OFF Hex or just written as OFFH), prepare the next place to move to (i.e. the spot where the asterisks are about to be put (determined by sense switch position), determine whether either of those (or both) result in an end of game situation, if so display the score, delay for a while and then go and start over, otherwise display the actual move, then go back and read the sense switches again.

A move is displayed by writing an asterisk into memory at the correct position to be displayed on the screen. The defines SCRNLOW and SCRNHIGH give the locations for the beginning and end of screen memory. For the VDM I used they are 0CC00H and 0D00H respectively, giving 16 lines of 64 characters, with automatic wrap-around from line to line (1K of memory is used total). It is easy to check whether the advancing line has exceeded the top or bottom of the screen by comparing with the values of the top and bottom. It is more difficult to determine whether it has come to the side of the screen. I do that by taking, in the case of the left edge, the value of the upper left hand corner, (0CC00H) and adding 40H to it until it reaches the lower left hand corner, compare it with the projected move (as determined by procedure MOVSOON) and seeing if they are equal. If so then a collision will occur, which of course is a "no-no." I do the same for the right hand edge.

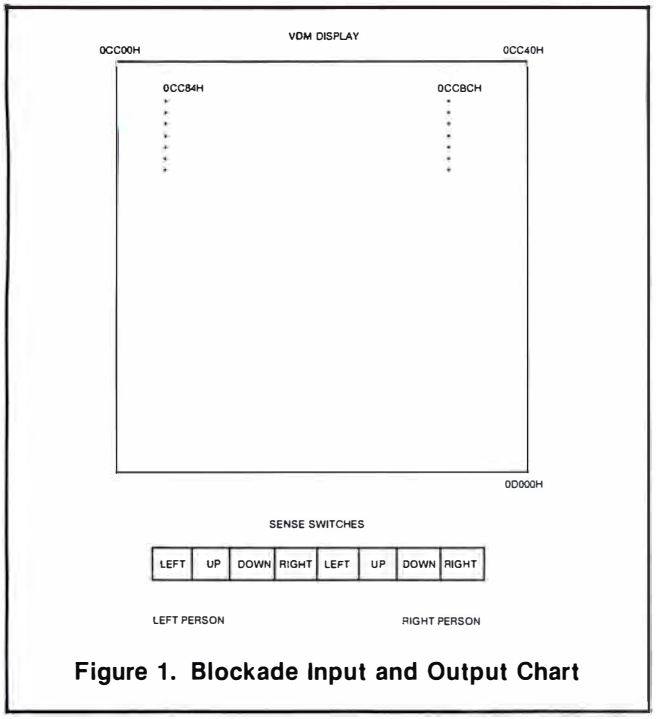


Figure 1. Blockade Input and Output Chart

The displayed asterisks are made to blink by setting bit 7 high. There may be other ways of doing this on other video boards, so check that out.

Procedure INSWITCH looks at the sense switches at each move. It then sets the variables LDIR and RDIR to indicate which direction to move based on what switch is up. The left four switches control the left hand asterisks and vice versa. The first switch indicates go left, second one go down, third go up, and fourth go right. If more than one switch is up the priority is: for the left side, 4, 5, 6, 7 and for the right, 3, 2, 1, 0. In other words, if you are the right hand player and you have switches 0 and 3 both up the line will go right. You may wish to make little paper or cardboard cut-outs to put above the switches to show the directions they indicate.

PL/M contains a built-in procedure called TIME that gives a delay loop. By calling this with a parameter equal to the number of times to delay 100 microseconds and then nesting that inside a DO loop it is easy to build up long delays. I do this to control the speed of the game and the delay between games.

The object code is in Intel hex format. This has been covered quite adequately in other articles and plenty of loaders exist for it. Thus I found it very convenient, if a little time consuming, to compile the source code on a large machine, a Burroughs B6700, save the object code on a disc file and then dump the file on my roommate's teletype.

The compiler, written by Gary Kildall in FORTRAN is a monstrous two-pass program. All in all it is hideously expensive to do a compilation. Unfortunately it does not output relocatable code. It is clean though and can be put into PROM. There are many output options and as shown here I obtained a cross referenced symbol table so that you can examine variable values if you wish.

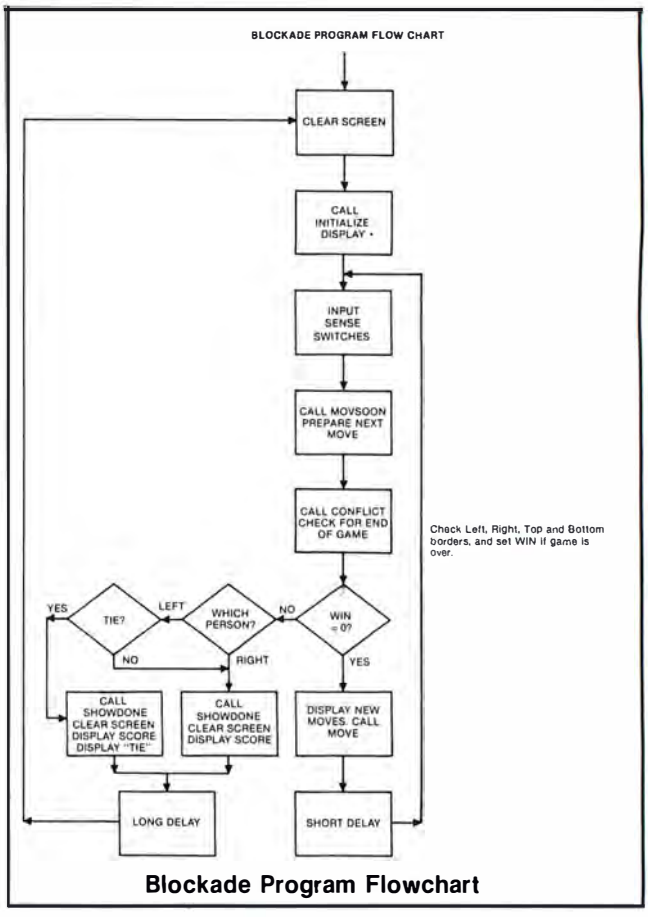
The object code starts at location zero and runs till location 0500H. It then puts the variables above that in memory so that it takes a little over half a K to run this game. The beauty of the Intel format is that the address is inherent in the listing.

That covers just about everything; now you can load it in and try it out. But beware the addiction power of this monster!

ASSEMBLY LISTING

```
#FILE (CCOKEN)BLOCKADE ON PACK
100 /*THE FOLLOWING ARE GLOBAL DEFINES*/
200 DECLARE
300      BLANK LITERALLY '20H'
400     ,SCRNLOW LITERALLY '0CC00H'
500     ,SCRNHIGH LITERALLY'0D000H'
600     ,CURSOR LITERALLY '0AAH'
700 /*THE FOLLOWING ARE GLOBAL VARIABLES*/
800   /*WIN      FLAGS A WINNING MOVE
900     TIE      FLAGS A TIE
1000     LDIR    INDICATES THE DIRECTION OF THE LEFT PERSON'S NEXT MOVE
1100     RDIR    INDICATES THE DIRECTION OF THE RIGHT PERSON'S NEXT MOVE
1200     LPOS    IS THE POSITION OF THE LEFT PERSON'S BLOCKADE
1300     LMOV    IS USED TO PUT A CHARACTER(THE CURSOR) AT THE NEXT POSITION
1400     RPOS    SEE LPOS
1500     RMOVE   SEE LMOV
1600     NEW     IS THE NEXT POSITION OF THE LEFT PERSON-PRIOR TO TESTING FOR L
1700             LEGALITY AND OR WIN
1800     NMOVL   IS USED FOR PUTTING A CHAR IN THE NEW POSITION
1900     NEWR    SEE NEWL
2000     NMOVR   SEE NMOVL
2100     I       IS A GENERAL ALL PURPOSE INDEX
2200     B       IS A GENERAL ALL PURPOSE BYTE
2300     LEFT    IS THE LEFT PERSON'S SCORE
2400     RIGHT   IS THE RIGHT PERSON'S SCORE
2500  */
2600     ,WIN BYTE
2700     ,TIE BYTE
2800     ,LDIR BYTE
2900     ,RDIR BYTE
3000  ;
3100 DECLARE (AGAIN,BACK) LABEL;
3200   DECLARE
3300     LPOS ADDRESS
3400    ,LMOV BASED LPOS BYTE
3500    ,RPOS ADDRESS
3600    ,RMOV BASED RPOS BYTE
3700    ,NEWL ADDRESS
3800    ,NMOVL BASED NEWL BYTE
3900    ,NEWR ADDRESS
4000    ,NMOVR BASED NEWR BYTE;
4100   DECLARE
4200     I ADDRESS
4300    ,B BASED I BYTE
4400    ,LEFT BYTE
4500    ,RIGHT BYTE
4600    ;
4700   /*DONE WITH DECLARATIONS-NOW THE PROCEDURES*/
4800
4900 /*************************************************************/
5000
5100  CLEARSCRN : PROCEDURE;
5200
5300 /*************************************************************/
5400
5500 /*THIS PROCEDURE ENTERS BLANKS INTO THE VDM SCREEN
5600   FOR USE BETWEEN GAMES ETC*/
5700 OUTPUT(0C8H)=00H;
5800     DO I = SCRNLOW TO SCRNHIGH
5900       ;
6000      B = BLANK;
6100 OUTPUT(0C8H)=00H;
6200     END;
6300 END CLEARSCRN;
6400
6500
6600 /*************************************************************/
6700
6800 INIT: PROCEDURE;
6900
7000 /*************************************************************/
7100
7200 /*THIS PROCEDURE OUTPUTS THE FIRST POSITIONS OF THE PLAYERS
7300   12 OVER AND 2 LINES DOWN FOR LEFT AND 12 OVER FROM RIGHT FOR RIGHT*/
7400  I=SCRNLOW+132;
7500 B=CURSOR;
7600  LPOS=I;
7700  I=SCRNLOW+187;
7800  B=CURSOR;
7900  RPOS=I;
8000   /*RPOS AND LPOS ALSO GET SET TO CURRENT POSITIONS*/
8100 END INIT;
8200
8300
8400 /*************************************************************/
8500
8600 INSWITCH: PROCEDURE;
8700
8800 /*************************************************************/
8900
9000 /*THIS IS CALLED TO INPUT FROM THE SENSE SWITCHES
9100   THEY ARE PORT OFFH.  THEN I OUTPUT IT TO THE PROGRAMMED OUTPUT
9200   LITES.  THEY MUST BE INVERTED FOR THAT.
9300 */
9400   DECLARE INNER BYTE;
9500     INNER=INPUT(OFFH);
9600     OUTPUT(OFFH) = NOT INNER;
9700 /*I JUST SHOVE THINGS TO THE LEFT AND THEN THE RIGHT TO MASK OUT ALL
9800   BUT THE DESIRED BIT.  IF SWITCHES ARE LEFT UP YOU CAN TELL THE
9900   THE PRIORITY OF WHICH GETS COUNTED BY LOOKING AT THE IF STATEMENTS
10000 */
10100   IF SHR(INNER,7) THEN LDIR=0;
10200   IF SHR(SHL(INNER,1),7) THEN LDIR = 1;
10300   IF SHR(SHL(INNER,2),7) THEN LDIR =2;
10400   IF SHR(SHL(INNER,3),7) THEN LDIR =3;
10500   IF SHR(SHL(INNER,7),7) THEN RDIR =3;
10600   IF SHR(SHL(INNER,6),7) THEN RDIR=2;
10700   IF SHR(SHL(INNER,5),7) THEN RDIR=1;
10800   IF SHR(SHL(INNER,4),7) THEN RDIR=0;
10900 END INSWITCH;
11000
11100 /*************************************************************/
11200
11300 MOVSOON: PROCEDURE;
11400
11500 /*************************************************************/
11600 /* THIS PROCEDURE DOES A CASE STATEMENT ON THE VALUES OF LDIR AND RDIR
11700    AS DETERMINED IN THE ABOVE PROCEDURE.
11800    IT SETS NEWL AND NEWR AS THE POTENTIAL LOCATIONS TO MOVE TO, AND
11900    LATER THESE ARE TESTED FOR LEGALITY.
12000     0 MOVES LEFT
12100     1 MOVES DOWN
12200     2 MOVES UP
12300     3 MOVE RIGHT
12400     THESE CORRESPOND TO SENSE SWITCHES AS FOLLOWS
12500      L D U R L D U R
12600 */
12700   DO CASE LDIR;
```

```
12800    NEWL=LPOS-1;
12900    NEWL=LPOS+64;
13000    NEWL=LPOS-64;
13100    NEWL=LPOS+1;
13200   END;
13300    DO CASE RDIR;
13400    NEWR=RPOS-1;
13500    NEWR=RPOS+64;
13600    NEWR=RPOS-64;
13700    NEWR=RPOS+1;
13800    END;
13900   /*NOW EVERYTHNG IS SET UP FOR TESTING-IF LEGAL THEN IT ACTUALLY DOES I
14000 IT*/
14100 END MOVSOON;
14200
14300
14400 /*****************************************************************/
14500
14600   MOVE: PROCEDURE;
14700
14800 /*****************************************************************/
14900 /*THIS IS CALLED WHEN IT IS TIME TO ACTUALLY DISPLAY THE NEW MOVE,
15000   AND MAKE THE CHANGES IN LPOS AND RPOS. IT DUMPS A CURSOR ONTO THE
15100   THE SCREEN IN THE RIGHT POSITION FOR EACH PLAYER.
15200 */
15300  LPOS=NEWL;
15400  LMOV=CURSOR;
15500  RPOS=NEWR;
15600  RMOV=CURSOR;
15700 END;
15800
15900 /*****************************************************************/
16000
16100 DELAY: PROCEDURE;
16200
16300 /*****************************************************************/
16400
16500 /*IF YOU WANT TO CHANGE THE SPEED OF THE GAME-CHANGE THE NUMBER OF
16600   ITERATIONS OF THE DO LOOP
16700 */
16800   DO I= 1 TO 11;
16900    CALL TIME(250);
17000   END;
17100  END DELAY;
17200
17300 /*****************************************************************/
17400
17500  LONGDELAY: PROCEDURE;
17600
17700 /*****************************************************************/
17800
17900 /*GIVES A NICE PAUSE BEFORE THE NEXT MATCH*/
18000   CALL DELAY;
18100   CALL DELAY;
18200   CALL DELAY;
18300   CALL DELAY;
18400   CALL DELAY;
```



Blockade Program Flowchart

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```
18500   CALL DELAY;
18600   CALL DELAY;
18700  END LONGDELAY;
18800
18900 /*************************************************************/
19000
19100 SHOWDONE: PROCEDURE;
19200
19300 /*************************************************************/
19400
19500 /*THIS PROCEDURE IS CALLED WHEN A MATCH FINISHES (AFTER CALLING
19600   CONFLICT).
19700    FIRST IT CALLS A LONGDELAY-FOR A PAUSE THAT REFRESHES AS IT WERE
19800    THEN IF WIN=1 THE LEFT PERSON'S SCORE IS INCREMENTED-OTHERWISE
19900    THE RIGHT PERSON'S SCORE IS INCREMENTED.  BUT IF IT IS A TIE
20000    THEN IT SUBTRACTS FROM THE LEFT PERSON'S SCORE SINCE THAT WILL
20100    ALWAYS BE INCORRECTLY INCREMENTED IN A TIE CASE.
20200    AFTER ALL THAT GARBAGE IT OUTPUTS THE SCORE TO THE SCREEN,
20300    AND IF EITHER PERSON HAS REACHED 9 POINTS IT DISPLAYS A GAME OVER
20400    MESSAGE AND RESETS THE SCORES TO 0 THEN RETURNS AND STARTS THE
20500    NEXT GAME.
20600 */
20700 CALL LONGDELAY;
20800 CALL CLEARSCRN;
20900  IF WIN = 1 THEN
21000     LEFT=LEFT+1;
21100     ELSE
21200     RIGHT=RIGHT+1;
21300     IF TIE=1 THEN LEFT=LEFT-1;
21400  /*HERE IT OUTPUTS THE SCORES*/
21500  I=OCC1OH;
21600  B=LEFT+30H;
21700  I=OCC20H;
21800  B=RIGHT+30H;
21900  /*HERE IT TAKES CARE OF TIES*/
22000  IF TIE=1 THEN DO;
22100   /*THE FOLLOWING IS A BASTARD USE OF LMOV AND LPOS*/
22200               LPOS='TIE';
22300               DO I  = OCC95H TO OCC98H;
22400               B=LMOV;
22500                LPOS=LPOS+1;
22600                END;
22700               END;
22800  /*NOW IT TESTS FOR SCORES OF 9 FOR GAME OVER SITUATIONS*/
22900  IF LEFT >=9 OR RIGHT >= 9 THEN
23000   DO;
23100    LPOS='MATCH OVER';
23200    DO I= OCCD5H TO OCCDFH;
23300    B=LMOV;; /*PUT THE LETTER THERE*/
23400    LPOS=LPOS+1;
23500    END;
23600   RIGHT=0;LEFT=0;
23700   END;
23800  /*ALL DONE*/
23900  END SHOWDONE;
24000
24100 /*************************************************************/
24200
24300  CONFLICT: PROCEDURE BYTE;
24400
24500 /*************************************************************/
24600
24700 /*THE MESSY PART
24800    FIRST IT RUNS DOWN THE LEFT BORDER TESTING FOR
24900    COLLISION WITH THAT
25000  */
25100 DECLARE TESTADR ADDRESS;
25200  DO TESTADR = OCCOOH TO OCF40H BY 40H;
25300        IF NEWL = TESTADR THEN RETURN 1;
25400        IF NEWR = TESTADR THEN RETURN 3;
25500  END; /*OF LEFT BORDER*/
25600   /*NOW IT LOOKS AT THE RIGHT BORDER*/
25700  DO TESTADR = OCC3FH TO  OCF7FH  BY 40H;
25800        IF NEWL = TESTADR THEN RETURN 1;
25900        IF NEWR = TESTADR THEN RETURN 3;
26000  END; /*OF RIGHT BORDER*/
26100 /* THEN IT LOOKS TO SEE IF IT RAN OFF THE TOP*/
26200  IF NEWL < OCCOOH THEN RETURN 1;
26300  IF NEWR < OCCOOH THEN RETURN 3;
26400   /*END OF TOP TEST*/
26500 /* AND FINALLY IT LOOKS AT THE BOTTOM*/
26600    IF NEWL > SCRNHIGH THEN RETURN 1;
26700    IF NEWR > SCRNHIGH THEN RETURN 3;
26800   /*END OF BOTTOM TEST*/
26900   /*COLLISION TEST*/
27000 /* NOW IT LOOKS TO SEE IF SOMEONE HAS ALREADY GONE THERE*/
27100  IF NMOVL=CURSOR THEN RETURN 1;
27200  IF NMOVR = CURSOR THEN RETURN 3;
27300  RETURN 0;
27400 /* IT RETURNS 0 IF NO CONFLICT 1 IF LEFT PERSON
27500     BLEW IT AND 3 IF RIGHT PERSON BLEW IT
27600 */
27700 END; /*OF CONFLICT*/
27800
27900
28000 /*************************************************************/
28100
28200 /*MAIN PROGRAM*/
28300
28400
28500 /*SET THE SCORES TO ZERO*/
28600 LEFT,RIGHT=0;
28700   /*HERE IS WHERE IT COMES TO PLAY ANOTHER GAME*/
28800 AGAIN: LDIR,RDIR=1;
28900 /*YOU MUST INITIALIZE TIE TO 0 FIRST OF ALL*/
29000 TIE=0;
29100  OUTPUT(0C8H)=00H;
29200 /*THEN CLEAR THE SCREEN AND INITIALIZE THE SYSTEM*/
29300    CALL CLEARSCRN;
29400    CALL INIT;
29500 /*   HERE IS THE MAIN LOOP  */
29600 /*   IT GETS TO HERE AT EACH MOVE  */
29700   BACK:
29800 /* READS THE SWITCHES-THEN SETS UP THE NEXT MOVE */
29900     CALL INSWITCH;
30000    CALL MOVSOON;
30100 /* NOW LOOK FOR CONFLICTS-IF NONE THEN GO DOWN BELOW
30200    ELSE START MESSING AROUND WITH SCORING ETC
30300 */
30400    WIN=CONFLICT;
30500
30600      IF WIN <> 0 THEN
30700          DO;
30800          IF WIN = 1 THEN
30900   /*LEFT PERSON CONFLICT-TIME TO CHECK FOR TIE*/
31000   /*THIS IS BECAUSE THE LEFT PERSON IS ALWAYS CHECKED FIRST-IF
31100    CONFLICT THEN NEVER CHECK FOR THE RIGHT PERSON- SO WE
31200    MAKE SURE THERE IS NO LEFT CONFLICT THEN LOOKAT AT RIGHT PERSON */
31300          DO;
31400         /*SET THE LEFT THINGEE IN A SAFE SPOT-STILL CONFLICT?*/
31500             NEWL=OCFFFH;
31600             IF CONFLICT = 1 THEN
31700               DO;
31800         /*IF SO THEN PUT IT SOMEWHERE ELSE AND TRY AGAIN      */
31900                 NEWL=OCC01H;
32000                 IF CONFLICT=3 THEN
32100                   TIE=1;
32200               END;
32300                ELSE
32400                 IF CONFLICT=3 THEN TIE=1;
32500            END;
32600    /*IF IT GETS TO HERE ITS DECIDED WHETHER ITS A TIE OR NOT, BUT
32700      IN ANY CASE THE GAME IS OVER. SO NOW IT CALS SHOWDONE TO
32800      DISPLAY THE SCORE THEN A LONGDELAY FOR A PAUSE.
32900    */
33000          CALL SHOWDONE;
33100          CALL LONGDELAY;
33200            GO TO AGAIN; /*GO START A NEW GAME*/
33300        END;
33400     ELSE
33500    /*DOWN HERE IF NO CONFLICT-MAKE THE MOVE PERMENENT BY CALLING MOVE
33600      THEN DELAY AND GO BACK FOR THE NEXT MOVE.
33700    */
33800      DO;
33900      CALL MOVE;
34000      CALL DELAY;
34100      GO TO BACK;
34200      END;
34300 ;
34400  /*NOW IF IT FALLS THRU THE GAME IS OVER AND TIME TO
34500       START A NEW ONE.  IT SHOULDN'T GET HERE, BUT.....
34600  */
34700  GO TO AGAIN;
34800 EOF
```

OBJECT LISTING

```
L AUXSYM
#FILE (CCOKEN)AUXSYM ON PACK
100       5 MEMORY 00500H
200      24 WIN 004ECH
300      25 TIE 004EDH
400      26 LDIR 004EEH
500      27 RDIR 004EFH
600      28 AGAIN 00414H
700      29 BACK 00429H
800      30 LPOS 004F0H
900      32 RPOS 004F2H
1000      34 NEWL 004F4H
1100      36 NEWR 004F6H
1200      38 I 004F8H
1300      40 LEFT 004FBH
1400      41 RIGHT 004FCH
1500      42 CLEARSCRN 00006H
1600      51 INIT 00038H
1700      56 INSWITCH 00067H
1800      58 INNER 004FDH
1900      75 MOVSOON 00123H
2000      92 MOVE 001C2H
2100      94 DELAY 001E3H
2200     100 LONGDELAY 00215H
2300     102 SHOWDONE 0022BH
2400     125 CONFLICT 0031AH
2500     127 TESTADR 004FEH
2600   $
2700  ********** ******************************
2800  :100000031EC04C30C04AFD3C821F804360023360 6
2900  :10001000CCAF06D021F804962C4F789EDA37002A10
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8200  :1003600081C234033E03C92U363F2336CC3E7F064F
8300  :1003700CF21FE04962C4F789EDAB203C3BC030182
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8500  :10039000462EFE962C4F789EB1C29F033E01C92E79
8600  :1003A000F67E2C462EFE962C4F789EB1C27F033EE1
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9900  :1004700043601CD2B02CD1502C31404CDC201CD2B
10000  :0A048000E301C32904C31404FB7652
10100  :00000001FF
10200  **********************************************
10300   $
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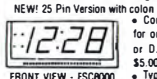

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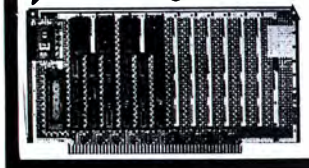

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0822 — Baseball (2 players)

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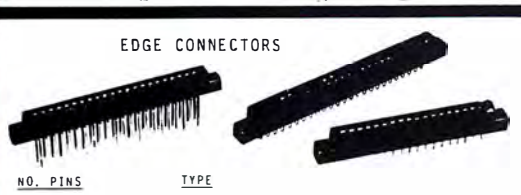

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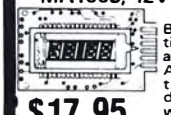

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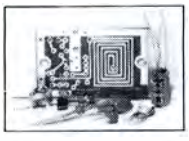

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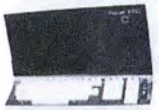

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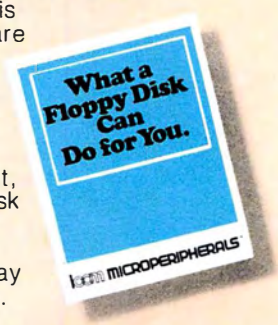

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John Montagna, computer engineer (above left), lead this successful network team in generating election results speedily, efficiently and reliably using predominantly TDL hardware and software. Montagna created three programs to get the job done. The text for a SWAPPER program was written and assembled using the TDL TEXT EDITOR and Z80 RELOCATING MACRO ASSEMBLER. The SWAPPER text and all debugging was run through TDL's ZAPPLE MONITOR. The relocatable object code was punched onto paper tape. A MAIN USERS program updated votes and controlled air display. An ALTERNATE USERS program got hard copy out and votes in. The latter two programs were written in BASIC. Montagna modified the ZAPPLE BASIC to permit time-sharing between the two USERS programs.

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